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ABSTRACT

This mining careers and safety curriculum guide was developed to be used in a senior level high school course (175 two-hour class periods). Course goals include certification that students have completed the forty-eight hours of new underground coal mining training required by federal law. Twenty-three units of instruction are included: History of Coal; Geology of Coal; Chemistry of Coal; Use of Coal; Basic Introduction to Coal Mining; Mine Gases; Ventilation, and Dust Control; Fires and Explosions; Blasting; Roof and Rib Control; Electricity; Transportation and Communication; Modern Mining Methods: Underground; Drainage; Health and Safety; Modern Mining Methods: Surface; First Aid; Preparation, Sampling, and Analysis; Surveying and Mapping; Environment: Land, Water, Air; Labor Relations; Occupational Opportunities; and 48-hour Preemployment Review. Each unit contains five major sections: unit outline, objectives, resources, presentation and activities, and glossary of terms. Also included is a list of guidelines for field trips and a list of references. (LRA)

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FORWARD

This curriculum guide was written upon the completion of a program field-test under the project title, "Mining Careers and Safety Program." The project was conducted at Evarts High School in Harlan County. It field tested mining instructional techniques and curriculum materials and tested the delivery of mine safety training to high school students.

The mine safety component is adopted from MSHA mine safety programs in Kentucky. Students 18 years old or older who complete the program may receive a mine training permit and then may enter a mining career immediately.

INTRODUCTION

This Mining Careers and Safety Curriculum was developed to be used as a senior level high school course. The class will meet for two (2) hours each day for one hundred seventy five (175) days. Eight (8) field trips to various mining facilities have been scheduled. Field trips are an integral part of the course of study as they will provide the student with first-hand information and experiences that will enrich and expand the curriculum. The maximum classroom enrollment is fifteen students. The students will earn, with passing grades, two credits toward the obtainment of a high school diploma, and a permit issued by the Department of Mines and Minerals, certifying they have completed the 48 hours of new underground coal mining training required by federal law.

The minimum requirements of the instructor are four years of mining experience, with enrollment in a college or university to acquire six (6) hours of study per year. An instructor with a secondary teaching certificate and a mining engineering or mining technology degree is preferred.

There is, and will be, a greater need in the coal mining industry for more and better trained people in the technical aspects of coal mining, and who will have an appreciation, understanding, and dedication to safety within the industry. Because of the variety of jobs that are and will be available, the student needs to explore careers in the coal mining industry.

The training of high school seniors following the above objectives, is the goal of this course. We feel that with the students receiving hands-on-experiences through the depth and balance of technical mining elements, careers, and safety, the curriculum provides the basic instruction the student and coal mining industry needs.

Mary Stewart
Esaw Saylor
Richard McNabb

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SCOPE AND SEQUENCE

FIRST NINE WEEKS			SECOND NINE WEEKS			THIRD NINE WEEKS			FOURTH NINE WEEKS		
August 20, 1979 October 22, 1979			October 23, 1979 January 15, 1980			January 16, 1980 March 12, 1980			March 13, 1980 May 12, 1980		
Unit No.	Unit Title	No. Days	Unit No.	Unit Title	No. Days	Unit No.	Unit Title	No. Days	Unit No.	Unit Title	No. Days
1	History of Coal	3	7	Ventilation and Dust Control (Cont.)	5 F.T.	13	Modern Mining Methods Underground	16 F.T.	17	First Aid (Cont.)	10
2	Geology of Coal	4							18	Preparation, Sampling and Analysis	5 F.T
3	Chemistry of Coal	3	8	Fires and Explosions	10 F.T.	14	Drainage	2			
						15	Health & Safety	8 F.T.	19	Surveying and Mapping	4 F.T
4	Uses of Coal	3	9	Blasting	4						
5	Basic Introduction to Coal Mining	6 F.T.	10	Roof and Rib Control	15	16	Modern Mining Methods-Surface	9 F.T.	20	Environment - Land, Water, Air	4
			11	Electricity	7				21	Labor Relations	3
6	Mine Gases	13				17	First Aid	10			
			12	Transportation & Communication	3				22	Occupationa Opportunities	[illegible]
7	Ventilation and Dust Control	13									
									23	48-Hour Pre-Employment Review	11

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HISTORY OF COAL

HISTORY OF COAL MINING

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- II. COAL IN AMERICA
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- III. EARLY MINING METHODS
  - A. General Discussion of the Different Mining Methods

- IV. MECHANIZATION AND MODERN METHODS
  - A. Important Inventions
  - B. Developments Within the Coal Industry

- V. SURFACE MINING
  - A. Growth
  - B. Machinery Change

- VI. TRANSPORTATION
  - A. Shipping Growth
    - 1. Cost
    - 2. Methods

- VII. THE FUTURE OF COAL - PRODUCTIVITY AND ECONOMICS
  - A. Productivity
  - B. Economics
  - C. Laws That Affect Production

HISTORY OF COAL MINING

OBJECTIVES:

1. The student will be able to list at least three countries where coal was used in the distant past.
   1) Syria 2) Chinese 3) Whales 4) Romans
2. Given a map of the United States the student will be able to identify where the major coal fields are located and what type of coal is found there.
3. The student will be able to list in proper sequence the progress of the mining industry, from the beginning of hand-shoveled coal to continuous mining operation.

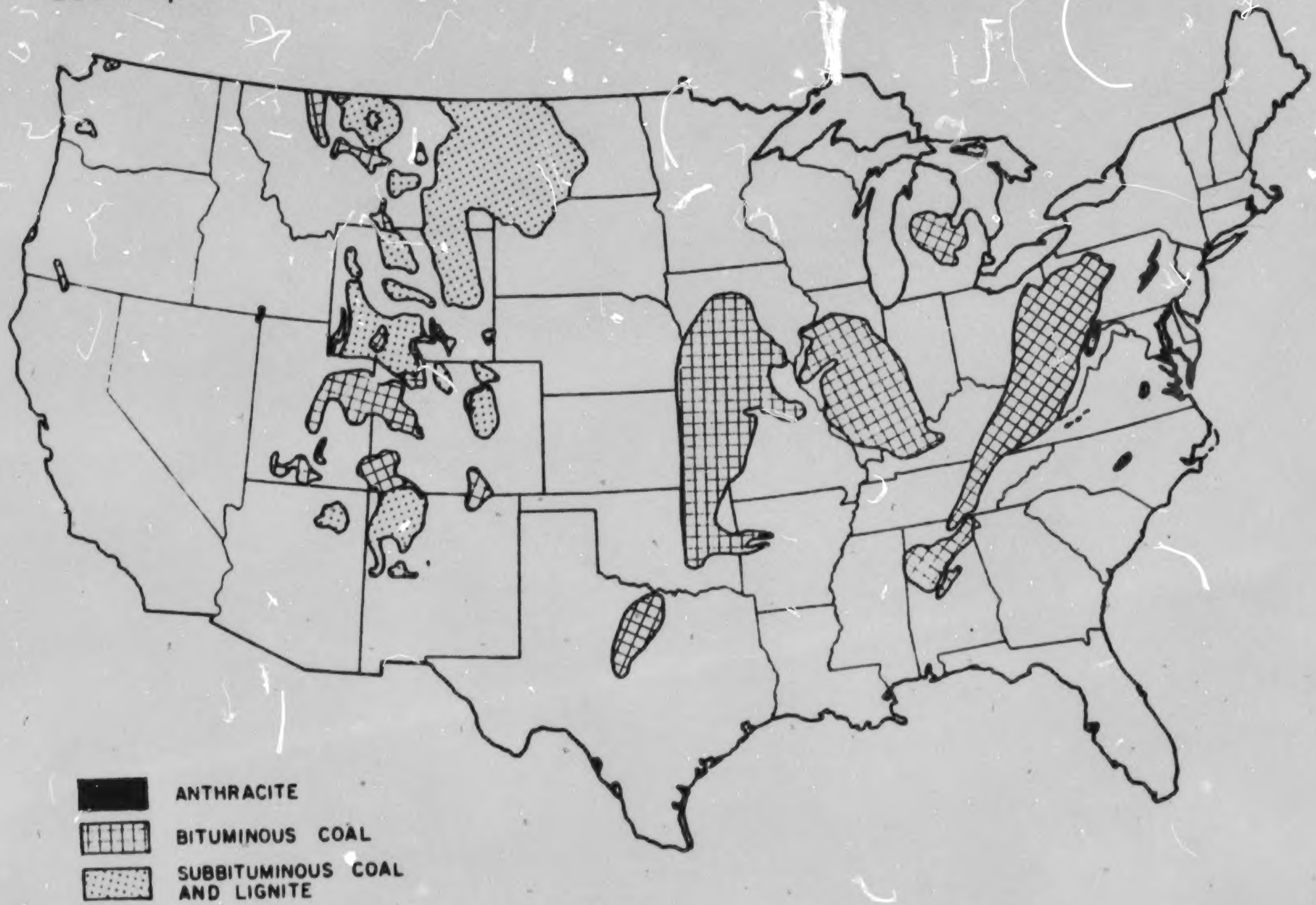
RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 1-10.
2. Film - "The Story of Coal".
3. MSHA Phamplet, Number 1 - "Coal Mining".

PRESENTATION AND ACTIVITIES:

1. Film - Classroom discussion.
2. Refer to map of location of coal areas.

Coal Deposits in the United States



■ ANTHRACITE
▦ BITUMINOUS COAL
▒ SUBBITUMINOUS COAL AND LIGNITE

GLOSSARY OF TERMS (History of Coal)

Anthracite - A hard, black lustrous coal containing very little volatile matter; hard coal.

Area stripping - Uncovering large areas of coal from gently rolling or nearly flat land. A practice used mainly in the Midwest states.

Auger mine - A mine (usually on the surface) in which the coal is removed by an auger.

Bed - A coal seam; a large deposit or layer of coal.

Bituminous - A coal with 15 to 50 percent volatile matter (gaseous constituents); soft coal.

Coal pillars - Blocks of coal left to support the overburden.

Continuous mining - A system of mining in which a mining machine (continuous miner) is used to cut or rip coal from the face and load the coal unto cars or converyors.

Contour stripping - Uncovering the overburden from a small area of coal along the outcrop of coal seams that follow the contour of the hills or mountains. A practice that is mainly used in the Appalachian coal fields.

Crosscut - A passageway driven at right or other angles to the main entry.

Cutting machine - A machine used to undercut or shear a coal face.

Highwall - The face or bank on the uphill side of a contour strip mine.

Lignite - A brownish black coal formed from peat.

Outcrop - The part of a coal seam that appears at or near the surface.

Overburden - The material that overlies a coal deposit.

Peat - A material formed in marshes and swamps from dead plant; it has a yellowish-brown to brownish black color.

Plow - A long wall machine used to remove coal by the cutting action of a set of blades.

Ripper - A machine used to rip coal from the face.

Roof bolter - Reinforces the roof of mine haulageways, drifts, and working places with metal or timber.

Seam - A large deposit or layer of coal.

Shearer - A long wall machine which shears coal from the face.

Shuttle car - A vehicle, usually powered by electric motors, used to transfer coal from the face area to the main transportation area.

GEOLOGY OF COAL

- I. GENERAL AND BASIC GEOLOGY
- II. ORIGIN OF COAL
  - A. The Amount of Plant Material
  - B. Types of Peat Land
  - C. Climate
  - D. Conditions Nesssary for Coal Formation
- III. DISTRIBUTION OF COALS IN THE ROCK SEQUENCE
  - A. Earliest Traces of Coal
  - B. Extensive Formation of Coal
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      - a. Mississippian
      - b. Pennsylvanian
  - C. The Average Depth of Coal Seams
- IV. GEOGRAPHIC DISTRIBUTION OF COAL
  - A. Principal Factors That Determined Minable Areas
  - B. Known Reserves
- V. NATURE OF COAL
  - A. Rank of Coal
    - 1. Factors Determing Rank
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      - b. Volatile Matter
      - c. Calorific Value (BTU)
    - 2. Classification of Coal By Rank
      - a. Anthracite
      - b. Bituminous
      - c. Subbituminous
      - d. Lignite
- VI. CONSTITUTION OF COAL
  - A. Paleobotany
  - B. Petrography
  - C. Mineral Matter
    - 1. Clays
    - 2. Quartz
    - 3. Sulfur
      - a. Detrimental Aspects
- VII. GEOLOGIC FEATURES AFFECTING MINING OF COAL
  - A. Factors That Influence Thickness, Continuity, Quality, and Mining Conditions of Coal
    - 1. Shale Parting in Coal and Split Coal
    - 2. Washouts
    - 3. Dipping and Folded Strata
    - 4. Faults
    - 5. Clestic Dikes or Clay Veins
    - 6. Rolls
    - 7. Cleats and Fractures
    - 8. Concretions
    - 9. Mine Floor and Roof Strata

10. Igneous Intrusions
11. Gas
12. Rock Burst

VIII. GEOLOGIC EXPLORATION FOR COAL

GEOLOGY OF COAL

OBJECTIVES:

1. Given a chart of the geologic periods, the student will identify the period in which most of the coal in Kentucky and other areas of the nation was formed.
2. Through independent research and use of reference materials, the student will write a report on the origin of coal.
3. The student will be able to list at least five conditions necessary for accumulation of peat that could be subsequently converted to coal.
4. The student will be able to describe the geologic features that affect the mining of coal.
5. The student will be able to classify coal according to various ranks.
6. The student will be able to explain two types of coal constituents - paleobotany and petrography.
7. The student will identify and undesired element found in coal which forms the ash when coal is burned.

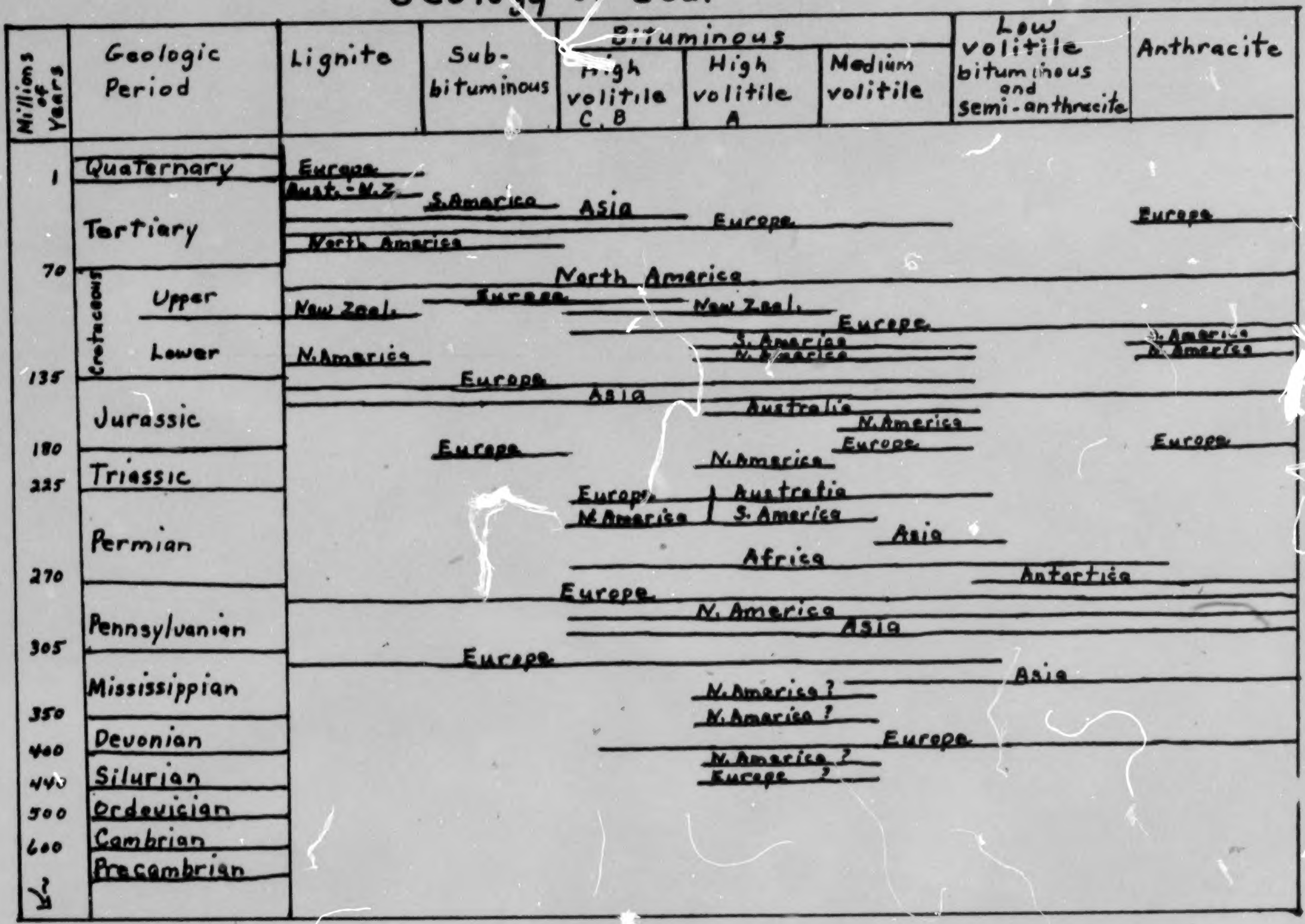
RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 2-39.
2. Paper "Formation of Coal" - Esaw Saylor.

PRESENTATIONS AND ACTIVITIES:

1. Geologic Age Chart - hand out to student.
2. Independent research.
3. Lecture and discussion. Paper on foundation of coal to be given to all students.

Geology of Coal



FORMATION OF COAL

Many think of coal as a black rock that will burn. Most everyone knows it is a good source of energy, but coal is more than just a black rock.

Coal is thought to have formed from the remains of plants that lived on earth millions of years ago. Therefore, coal is a type of sedimentary rock formed by the gradual buildup of plant matter over a very long period of time. This rock contains the solar energy taken in and trapped by plants millions of years ago.

In the case of coal, the natural materials were the remains of plants that grew in swamps long ago.

Plants were continually growing, dying, and being covered with stagnant swamp water. Since the swamp water had a low oxygen content, decay of the built-up material was slowed down.

Over a period of years, a deposit of paritally decayed plant material called peat was built up. This is the type of peat that gardeners use.

At some time, the build-up of peat stopped and the whole swamp was buried by sediment such as mud or sand that had been deposited over the peat deposits by rivers or streams.

As time passed, the peat deposit was buried deeper and deeper by new layers of sediment. Each layer added more weight, building up pressure on the peat.

This pressure became intense. Water contained in the peat was squeezed out. The peat's temperature rose. Chemical changes took place, some gases were driven off, and eventually, the whole mass became darker in color and more like rock.

Each of these changes help determine the type and quality of coal that was formed.

The temperature and pressure also help determine the type and amount of gas produced and if it escapes or remains trapped.

LOCATION OF COAL

We have already said that coal is presumed to be formed from plant material under pressure by layers of sediment for long periods or time.

Coal lies under the surface of the earth in large deposits called coal seams.

The term coal bed refers to the original peat bog bed which was compressed into the bottom of the sediment layers and later pressed into a layer of coal.

In effect, this coal bed is "sandwiched" between a layer of sediment below it and a layer of sediment above it. These coal beds, or seams, can be many miles wide and long.

There can be, and usually are, several coal seams at the same location but at different depths below the surface. Each of these seams indicates a time in the history of the earth when it was covered by the dense, swampy forest areas that provided the plant material which eventually became coal.

The rock material between the coal seams, on the other hand, comes from a period when the forest areas were being buried by sediment. These different periods were probably millions of years apart.

The coal seams are also of different thicknesses. This indicates that the periods of time during which they were formed were of different lengths.

Thick coal seams were formed during long periods of dense cover. Thin coal seams were formed when the earth was covered with swampy forest for a shorter period of time.

About 5 to 10 feet of plant matter was needed to produce 1 foot of coal. Thus, a 7 foot coal seam would have needed a 35 to 70 foot bed of original plant material.

The thickness of the coal seam can vary from just a few inches to many feet. One coal seam in Wyoming is 70 feet thick. Generally, coal seams less than 24 inches thick are considered unminable by deep mining methods.

Two terms that have to do with the thickness of the coal seams are high coal and low coal.

High coal refers to a thick coal seam which allows movement for large machines and miners to work standing up.

Low coal refers to thin seams, usually 36 inches or less.

It is possible for the coal seam to be too thick for much moving equipment or large machines and only hand mining operations can be used.

Coal seams may be level, sloped, rolling or tipped on end depending on how they have been affected by the cracking, rolling, or folding of the earth's crust.

The pitch of a coal seam is the angle at which the coal seam inclines below a horizontal line. The pitch is improtant in the selection of a mining method.

Some kinds of mining machinery cannot be used unless the coal seam is almost perfectly horizontal. The pitch will also determine which way water will flow when it is found in the mine.

Large coal deposits are found throughout the United States.

The four major areas of coal deposits in America include: western deposits in Arizona, New Mexico, Utah, Colarado, Wyoming, and Montana;mid-continent deposits in Texas, Oklahoma, Kansas, Nebraska, and Missouri; mid-west deposits in Illinois, Michigan, and Indiana;eastern deposits in Alabama, Tennessee, Kentucky, West Virginia, Ohio, and Pennsylvania.

Coal reserves are also located in Virginia, Maryland, North Carolina, Arkansas, Iowa, North and South Dakota, Idaho, Nevada, California, Oregon, Washington, and Alaska. Many of these states have active mining operations.

Most of the coal deposits in the eastern and mid-western states are mainly sub bituminous and lignite. A small amount of anthracite coal is found in eastern Pennsylvania and southern New England.

Over a fourth of the world's coal reserves are in the United States.

The U.S. produces about 25 percent of the world's coal. Other large coal-producing nations are the Chinese People's Republic (17%), the Soviet Union (12%), Great Britain (11%), West Germany (8%), Poland (7%), India (4%), and France, Japan, and South Africa (3% each).

Coal reserves are located in many other nations throughout the world. Afghanistan, Algeria, Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, Columbis, Czecholslovakia, East German, Hungary, Indonesia, Iran, Italy, North and South Korea, Madagascar, Mexico, Morocco, Mozambique, New Zealand, Nigeria, Norway, Pakistan, Peru, the Phillippines, Portugal, Rhodesia, Rumania, Spain, Taiwan, Tanzania, Thailand, Turkey, Venezela, Vietnam, Yugoslavia, and Zaire all have coal reserves. Many of the nations have active mining operations that account for about 7% of the world's coal production.

TYPES OF COAL

We just listed the types of coal found in the United States.

There are four major types: lignite, sub-bituminous, bituminous, and anthracite. Probably the easiest way to understand these types of coal is to think of them as the four ages of coal.

This aging process is the result of the actions of time and pressure on the coal.

Lignite is the "youngest" form of coal. It has been under pressure for a shorter time and undergone less of the change from peat to coal.

Commonly called brown coal because of its color, lignite is a very soft coal.

Sub-bituminous coal is similar to lignite but somewhat darker in color and harder. It is probably much older than lignite and has undergone more change.

Bituminous coal, even though it is commonly called soft coal, is darker and harder than lignite and sub-bituminous. This is because it is much older or has been under greater pressure and has undergone more changes than the other two types.

Anthracite coal, or hard coal, has undergone the most change of all and has become extremely hard. Anthracite is not older than bituminous coal; but because of local conditions, it has been under a much greater pressure.

There are many differences between each type of coal that affects the value and desirability of their use as a fuel. The age and conditions during the formation of the various types determine such things as the sulfur, ash, and iron content in each deposit of coal.

The most desirable type of coal for a particular job depends on what that job is. For example, anthracite is considered good for home heating because it produces much heat and little smoke. Bituminous is widely used in furnaces to power electrical generators.

Generally speaking, a high quality coal is one that has a low ash and sulfur content but produces large amounts of heat energy when burned. Again, however, the best quality coal for a particular use depends on that use.

Major differences between the types of coal are: each differs in composition, hardness, and color: since each is found at different depths different mining procedures are used; each has different wastes and impurities; each may be found with differing amounts of methane gas; each is different in total reserves of the amount left to mine; each type has different energy ratings.

Major similarities amoung the types of coal are: each contains carbon compounds; each will burn and was originally formed by plant material; each contains energy and all are usually found in the ground; each is mined.

Before a coal mining operation can begin, a great deal of information about the coal is needed. This information is gathered by detailed surveys and core drillings of the property to be mined.

These surveys and core samples will give the mining industry facts about all of the conditions that will affect the mining operation.

GLOSSARY OF TERMS (Geology of Coal)

Agglomerating character. Refers to a standard test made to determine whether a pulverized sample of coal will or will not fuse and form a solid button at an elevated temperature.

Angiosperms. Flowering plants.

Attrital. Derived from a wide variety of finely comminuted plant debris.

British Thermal Unit. (BTU) Commonly used to express calorific value, is the amount of heat required to raise one pound of water one degree Fahrenheit.

Calorific value. The heat produced by the combustion of coal.

Fixed carbon. The carbon residue of the organic material.

Fusain. Mineral charcoal.

Geologic period. The principal periods of time into which the earth history has been divided, and the approximate age of each period.

Geology. The study of the science of the earth, the rocks of which it is composed and the changes which the earth has undergone in the past or is undergoing now.

Gymnosperm. A seed-bearing plant, ancestral to some modern evergreens.

Igneous. Rocks produced under conditions involving intense heat, such as rocks of volcanic origin or rocks brystallized from molten magma.

Lycopod trees. Ancestors to present day club mosses.

Paleobotany. The study of the plant constituents of coal.

Peat. A material formed in marshes and swamps from dead plants; it has a yellowish-brown to brownish-black color.

Petrography. The study of the physical constituents of coal.

Pollen. Male spores of seed plants.

Sedimentary. Mineral or organic matter deposited by water, air, or ice, such as rocks.

Spores. Asexual reproductive bodies.

Splint coal. A hard, dull, blacky, grayish black coal with rough uneven fracture and granular texture, with very little vitrain in bands or in the attrial coal.

Vitrain. Derived from woody parts of plants.

Volatile matter. That portion of the organic matter which is driven off as a gas.

CHEMISTRY OF COAL

- I. DEFINITION

- II. PHYSICAL PROPERTIES OF COAL
  - A. Specific Gravity
  - B. Hardness
  - C. Grindability
  - D. Friability and Size Stability
  - E. Color and Luster
  - F. Fracture, Cleat, and Cleavage
  - G. Size
  - H. Weathering
  - I. Spontaneous Combustion

- III. CHEMICAL PROPERTIES OF COAL
  - A. Characteristics of Coal Determined By:
    - 1. Type of vegetation
    - 2. The extent of decay
    - 3. Pressure
    - 4. Foreign matter
    - 5. Wind or waterborne
    - 6. Foreign matter infiltrated in solution after coal was formed
    - 7. Heat
  - B. Carbon
  - C. Hydrogen
  - D. Sulfur
  - E. Oxygen
  - F. Nitrogen
  - G. Mineral Matter

- IV. COAL ANALYSIS
  - A. Introduction
  - B. Chemical Analysis
    - 1. Proximate analysis
      - a. Moisture
      - b. Volatile matter
      - c. Fixed carbon
      - d. Ash
  - 2. Calorific Value
  - 3. Sulfur Content

CHEMISTRY OF COAL

OBJECTIVES:

1. The student will be able to define the term coal.
2. Given information on the physical properties of coal, the chemistry of coal, the specific gravity of coal, and the hardness of coal, the student will be able to hypothesize that all these properties are interrelated to the production of coal.
3. The student will be able to list four items tested for in the proximate analysis of coal.
4. The student will be able to explain why a high calorific value in coal would be an advantage and why a high sulfur content would be a disadvantage.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 40-48.

PRESENTATION AND ACTIVITIES:

1. Lecture
2. Discussion

NOTE: A more thorough study of coal analysis will be made in the unit on "Sampling and Analysis" with a field trip to a coal preparation plant and laboratory.

GLOSSARY OF TERMS (Chemistry of Coal)

British Thermal Unit. (BTU) The amount of heat required to raise one pound of water one degree Farenheit.

Calorific value. The heat content of coal and is expressed in BTU (British Thermal Unit).

Chemical analysis. Tests made on coal to determine a) the proximate analysis, consiting of four items: moisture, volatile matter, fixed carbon, and ash, b) the calorific value, and c) the sulfur content.

Cleats. Vertical cleavages which cross the seam in two directions about at right angles to each other.

Coal. A term applied to vegetable matter which, through geological processes of heat and pressure, has had both its chemical and physical properties changed. Geologists classify coal as a rock rather than a mineral.

Color and luster. Coals vary in color from brown in lignite through a grayish black to jet black. The luster is the manner in which a body reflects light from its surface.

Fracture. Refers to the shape of the coal pieces as well as to the manner in which they break.

Friability and size stability. The ability of coal to withstand breakage in handling and shipping.

Grindability. The physical property of coal which determines the relative ease of pulverizing or grinding a coal.

Hardness. A term relating to a coal's structure. A coal is hard or soft-structured depending upon the composition and location of the coal bed.

Size. Sized coal is the result of separating mixed particles into groups of particles with the same approximate size, or into groups in which the range of particles is between definite maximum and minimum sizes.

Specific gravity. The ratio of the weight of the body in air and the weight of an equal body of water. The specific gravity of coal ranges between 1.25 and 1.70, generally increasing with rank.

Spontaneous combustion. The ignition or burning of a substance or body from the rapid oxidation of its own constituents, without heat from any external source.

Weathering. The tendency of coals, usually those lower in rank, to break apart when they dry out.

USES OF COAL

- I. INTRODUCTION
  - A. Demand for Coal
  - B. Coal Conversion
  - C. Experts
  - D. Electric Generation
  - E. Steel Market
  - F. Industrial and Manufacturing Processes
- II. DEFINITION OF TERMS, GRADES AND SPECIFICATION
  - A. Classification of Coal By Rank
    - 1. Anthracitic
    - 2. Bituminous
    - 3. Subbituminous
    - 4. Lignitic
  - B. Analysis Processes
    - 1. Elements and substances in coal
      - a. Hydrogen
      - b. Oxygen
      - c. Nitrogen
      - d. Sulfur
      - e. Fixed carbon
      - f. Volatile matter
      - g. BTU
      - h. Ash
    - 2. Ultimate analysis
      - a. Carbon
      - b. Nitrogen
      - c. Sulfur
      - d. Nitrogen
      - e. Ash
    - 3. Proximate analysis
      - a. Water (moisture)
      - b. Ash (minerals)
      - c. Volatile (gases)
      - d. Fixed carbon
- III. COMBUSTION
  - A. Markets
    - 1. Power plants
    - 2. Industrial and manufacturing industries
  - B. Ways of Burning Coal
    - 1. Grate burning
      - a. Description
      - b. Environmental effects
    - 2. Suspension burning
      - a. Blowing method
        - 1. Description
        - 2. Advantages and disadvantages
      - b. Cyclone furnace
        - 1. Description
        - 2. Advantages and disadvantages

- IV. CARBONIZATION
  - A. Coke
    - 1. Description
    - 2. Importance
    - 3. Most popular type of coke oven
      - a. By product or slot-type oven
        - 1. Description
  - B. Selection of Coke
    - 1. Agglomerating character
    - 2. Low-moisture
    - 3. Low volatile
    - 4. Low matter
    - 5. Low sulfur
    - 6. Low phosphorus
    - 7. Low ash
  - C. Blending of Coals
    - 1. Stronger
    - 2. Better quality

- V. GASIFICATION
  - A. Converting Coal to a Gas
    - 1. Description
    - 2. Feasibility
  - B. Different processes
    - 1. HYGAS process
      - a. Description
    - 2. BI-GAS process
      - a. Description
      - b. Advantages
    - 3. The CO_2 Acceptor process
      - a. Description
      - b. Advantages
    - 4. The Synthane process
      - a. Description

- VI. LIQUEFACTION
  - A. Converting Coal to a Liquid
    - 1. Description
    - 2. Relationship of cost of gas from coal to gas from oil

- VII. ENVIRONMENTAL PROBLEMS IN THE USE OF COAL
  - A. Products of Combustion
    - 1. Methods of removing particulate matter
      - a. Mechanical dust separators
        - 1. Description
      - b. Electrostatic precipitators
        - 1. Description
      - c. Bag filters
        - 1. Description
      - d. Scrubbers
        - 1. Description
  - B. Sulfur Removal
    - 1. Pyritic sulfur
      - a. Pulverization
        - 1. Washing

2. Sulfur oxides
   a. Removal processes
      1. Chemical processes
         a. Description
         b. Advantages
      2. Limestone injection process
         a. Description
         b. Advantages

VIII. TRANSPORTATION
   A. Transportation Systems
      1. By rail
         a. Description
         b. Advantages
      2. Barges
         a. Description
         b. Advantages
      3. Overland belt
         a. Description
      4. Slurry pipeline
         a. Description

IX. SUMMARY

USE OF COAL

Introduction
Definitions of Terms, Grades, and Specifications

OBJECTIVES:

1. The student will be able to give percentages of the known fuel reserves of coal, oil, and gas in the United States.
2. The student will be able to name major consumers of coal and to relate how this consumption has fluctuated since 1961.
3. The student will be able to list four types of coal found in the United States.
4. The student will be able to identify the major elements found in coal.
5. The student will be able to describe two types of tests used in the analysis of coal.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 49-54.

PRESENTATION AND ACTIVITIES:

1. Refer to map of coal reserves given in previous unit.
2. Lecture.
3. Assigned readings.

USES OF COAL

Combustion
Carbonization

OBJECTIVES:

1. The student will be able to describe three ways of burning coal and the environmental effects of each.

   a) grate b) suspension c) cyclone furnace

2. The student will be able to define "coal carbonization".
3. The student will be able to state the process by which coke is formed.
4. The student will be able to identify the chemical properties of good quality coke.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 57-59.

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Assigned readings.

USES OF COAL

Gasification
Liquefaction

OBJECTIVES:

1. The student will be able to describe four types of processes used to convert coal to gas.

   a) HY Gas b) BI Gas c) CO_2 Acceptor d) Synthane

2. The student will be able to list advantages and disadvantages ~~to~~ of each of the above mentioned processes.

3. The student will become aware of the national attention now being given to coal gasification and liquefaction and cut and file all newspaper clippings pertaining to coal conversion in a notebook.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 59-64.
2. Newspaper clippings.

PRESENTATION AND ACTIVITIES:

1. Opague projector - diagrams of gasification processes.
2. Discussion of current news items pertaining to gasification and liquefaction of coal.
3. Assigned readings.

USES OF COAL

Environmental Problems in the Use of Coal
Transportation

OBJECTIVES:

1. The student will be able to list the unwanted products of combustion.
2. The student will be able to define "particulate matter".
3. The student will be able to describe four types of control equipment used to collect particulate matter.

   a) mechanical dust separator b) electrostatic precipitators c) bag filters d) scrubbers
4. The student will be able to describe processes used to remove sulfur from the coal.

   a) pulverizing b) washing c) limestone injection process
5. The student will be able to list various transportation systems used to transport coal and describe advantages and disadvantages of each.

   a) rail b) barge c) overland belt d) slurry

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 64-71.

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Assigned readings.

GLOSSARY OF TERMS (Uses of Coal)

Anthracite. A hard, black lustrous coal containing very little volatile matter; hard coal.

Bituminous. A coal with 15 to 50 per cent volatile matter; soft coal.

Coal carbonization. The destructive distillation of bituminous coal by heating it in the absence of air; this is the process by which bituminous coal is converted into coke, gaseous, and liquid processes.

Combustion. The act or process of burning.

Lignite. A brownish black coal formed from peat.

Particulate matter. The ash material and unburned carbon in fine dust form.

Proximate analysis. Test of coal properties involving four constituents: a) moisture b) ash c) volatile matter d) fixed carbon.

Ultimate analysis. Test of coal properties involving the determination of the carbon and hydrogen in the gaseous products of combustion, the determination of sulfur, nitrogen, and ash in the material as a whole and an estimation of oxygen by difference.

Unit train. Trainload lots, usually 5,000 to 10,000 tons, leaves one loading zone and has one destination.

"A BASIC INTRODUCTION TO UNDERGROUND COAL MINING"

The vast majority of high school seniors are unfamiliar with the environment of the underground coal mines. With this fact known we have developed this unit in conjunction with a field trip to familiarize the students to the basic underground terms that will facilitate learning throughout the course.

This understanding of the environment will lay the foundation that will make the material more relevant, easier and faster to learn. These terms will be covered more extensively in later units.

I. MINE GASES AND VENTILATION TERMS
    A. Ventilation
    B. Ventilating Current
    C. Main Fan
    D. Entry
    E. Breaks or Crosscuts
    F. Stoppings
    G. Check Curtain
    H. Line Brattice
    I. Working Place
    J. Face
    K. Heading
    L. Rib
    M. Floor
    N. Roof
    O. Pillar
    P. Methane
    Q. Carbon Monoxide
    R. Oxygen
    S. Last Open Crosscut
    T. Inby
    U. Outby

II. ROOF CONTROL TERMS
    A. Bolting
    B. Timbering
    C. Roof Bolting Machine
    D. Roof Bolts
    E. Temporary Supports
    F. Permanent Supports
    G. Overburden
    H. Strata
    I. Torqueing A Bolt

III. FIRES AND EXPLOSIONS
    A. Rockdust
    B. Gassey Mine
    C. Propagate
    D. Barricade
    E. Explosive Mixture

IV. TRANSPORTATION

A. Mantrip
B. Trolley Wire
C. Belt Conveyor (Belt Line)
D. Scoop
E. Continuous Miner
F. Cutting Machine
G. Shuttle Car
H. Ram Car
I. Track
J. Feeder
K. Shuttle Car Cable
L. Batteries (Ram Car and Scoop)
M. Power Center
N. Ingrest
O. Egrest

V. GENERAL SAFETY RULES AND LAWS

A. Transportation Hazards and Laws
    1. Personnel haulage on conveyor belt.
    2. Personnel haulage on track.
B. Personal Protection.
    1. Hat
    2. Steel toe boots
    3. Gloves
    4. Self rescuer
        a. How to use
    5. Clothing
    6. Knee pads
C. Personal Identification
    1. Name tag
    2. Check-in and check-out
D. Laws Concerning:
    1. Alchol use
    2. Smoking

A BASIC INTRODUCTION TO COAL MINING

OBJECTIVES:

1. The student will be introduced to basic terminology that will form a foundation for understanding the environment of underground coal mines and will facilitate the internalization of the course material in subsequent units.
2. The student will be introduced to general safety laws, personal identification requirements, and laws regarding smoking and alcohol.

RESOURCES:

1. Glossary of terms in units:
   a) Mine Gases
   b) Ventilation
   c) Roof Control
   d) Fires and Explosions
   e) Transportation
2. Code of Federal Regulations, July, 1978, Revised Edition 75.1715, 75.1702.

PRESENTATION AND ACTIVITIES:

1. The instructor will go over basic terminology in preparation for a field trip to an underground mine.
2. Federal guidelines that are relevant to personal safety and identification will be discussed.
3. Issue hats, belts, ear muffs, boots, and other equipment necessary to enter the mine.

A BASIC INTRODUCTION TO COAL MINING

Field Trip #1

OBJECTIVES:

1. The student will be able to describe the atmosphere and feelings of being "underground".
2. The student will be able relate the terminology studied in previous lesson to actual conditions and equipment found in the mine.
3. The student will write a paper describing the visit to the coal mine.
4. The student will be able to interview personnel as to their job responsibilities.

RESOURCES:

1. Eastover Coal Mining Company - Highsplint - Idle Continuous Mining Section.

PRESENTATION AND ACTIVITIES:

1. Field trip.

MINE GASES

- I. AIR

- II. CHEMISTRY OF GASES
  - A. Introduction
  - B. Definitions
    - 1. Matter
    - 2. A Mass
    - 3. A Molecule
    - 4. An Atom
    - 5. An Element
    - 6. A Compound
    - 7. A Mixture
    - 8. A Chemical Symbol
    - 9. Specific Gravity
    - 10. Diffusion

- III. PHYSICS OF GASES
  - A. Introduction
  - B. Definitions
    - 1. Atmosphere Pressure
    - 2. Atmosphere
    - 3. Absolute Pressure
    - 4. Marometer
    - 5. Absolute Zero
    - 6. Absolute Temperature

- IV. THE EFFECTS OF PRESSURE, TEMPERATURE, AND VOLUME OF MINE AIR
  - A. Pressure and Volume of Air
  - B. Temperature and Volume of Air
  - C. Weight of Air

- V. PROPERTIES, CHARACTERISTICS, AND DETECTION OF MINE GASES
  - A. Hydrogen
    - 1. Description
    - 2. Methods of Detection
  - B. Methane
    - 1. Description
    - 2. Causes, Effects, and Prevention of Methane Accumulation
    - 3. Methods of Detection
      - a. Flame Safety Lamp
        - 1. Types
        - 2. Nomenclature, purpose, and use of flame safety lamp (hands on)
      - b. Methanometer
        - 1. Types
        - 2. Purpose and usage
  - C. Water Vapor
    - 1. Description
    - 2. Detection
  - D. Nitrogen
    - 1. Description and Sources
    - 2. Methods of Detection

- E. Oxygen
    - 1. Description
    - 2. Methods of Detection
        - a. Flame safety lamp
        - b. Oxygen detection
- F. Carbon Monoxide
    - 1. Description and sources
    - 2. Methods of Detection
- G. Hydrogen Sulfide
    - 1. Description and Sources
    - 2. Methods of Detection
- H. Carbon Dioxide
    - 1. Description and Sources
    - 2. Methods of Detection
- I. Breathing Apparatus
    - 1. Self-Rescuer - Parts and Usage
    - 2. All-Service Gas Mask - Parts and Usage
    - 3. Self-Contained Oxygen Breathing Apparatus
        - a. Drager oxygen breathing apparatus
            - 1. Parts and usage
        - b. McCaa oxygen breathing apparatus
            - 1. Parts and usage
        - c. Chemox oxygen breathing apparatus
            - 1. Parts and usage
    - 4. Dust Respirator
        - a. Parts and usage

MINE GASES

Characteristics of Air
Common Mine Gases

OBJECTIVES:

1. Given the description and characteristics of underground mine air, the student will state the cause and effect due to the rise and fall of temperature on the outside.
2. Given the terms, "blackdamp", and "stinkdamp", the student will match the correct term with the gas to which it refers.
3. The student will be able to state the relationship of the above terms to the way each received its name.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 187-189.
2. Kentucky Mine Safety Training Program "Common Mine Gases" 13-2
3. Coal Mining Reference Book - Pages 1-4.

PRESENTATION AND ACTIVITIES:

1. Lecture
    a) Characteristics of mine air
    b) Definition of terms
2. Slide - cassette
    a) Descriptions relating to mine atmosphere:
        1) Carbon monoxide
        2) Carbon dioxide
        3) Oxygen deficiency
        4) Blackdamp
        5) Firedamp
3. Assigned readings

MINE GASES

Chemistry of Gases

OBJECTIVES;

1. The student will be able to define terms which are frequently used in the study of mine gases.
   element atom molecule mixture chemical compound
   specific gravity matter diffusion mass
   chemical symbol
2. The student will illustrate the composition of mine gas by making a drawing of molecules of mine gases showing the number of atoms of elements of each molecule of gas.

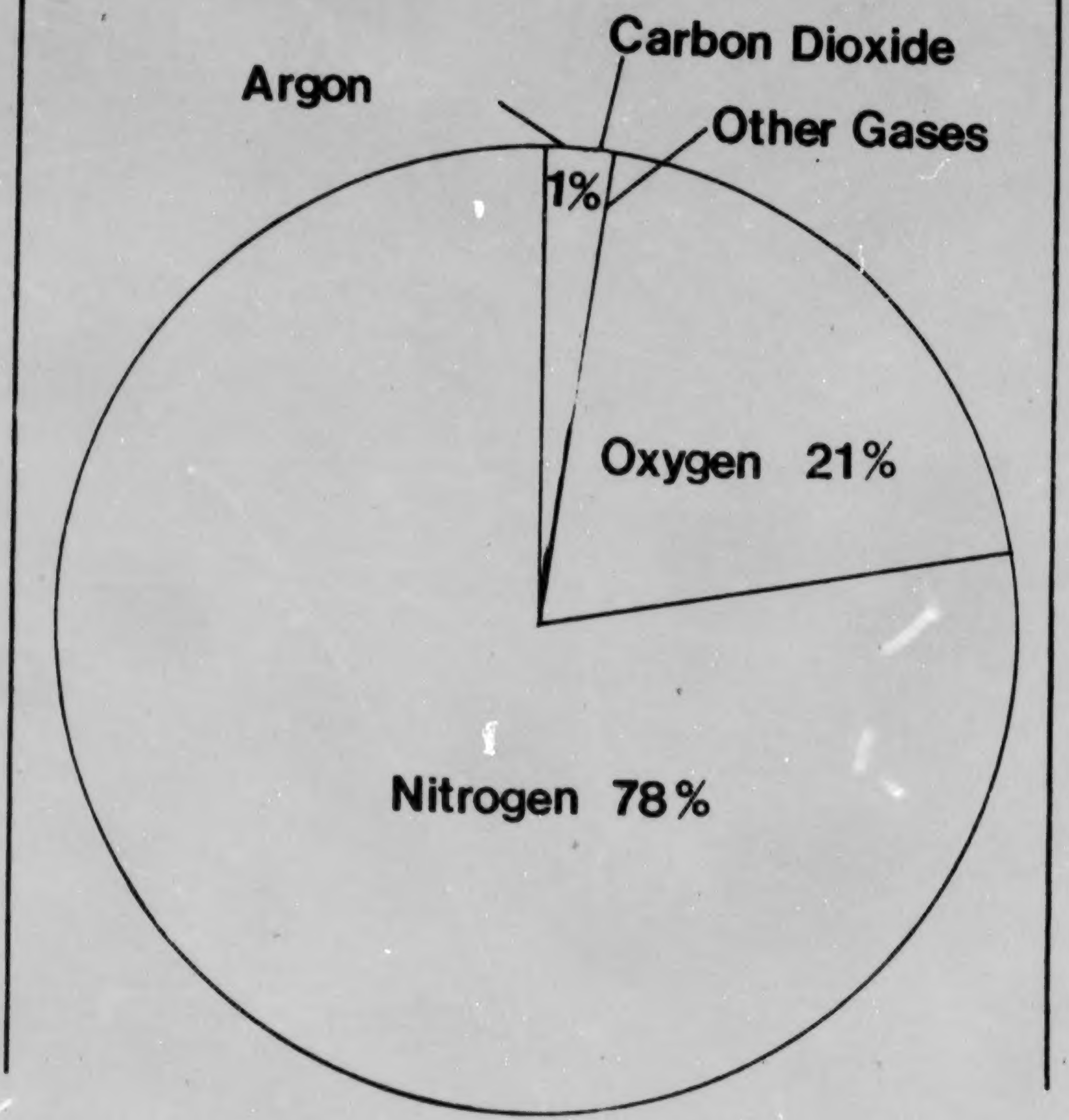
RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 189-192.
2. Chart - Chemistry Symbols
3. Coal Mining Reference Book - Page 2.

PRESENTATION AND ACTIVITIES:

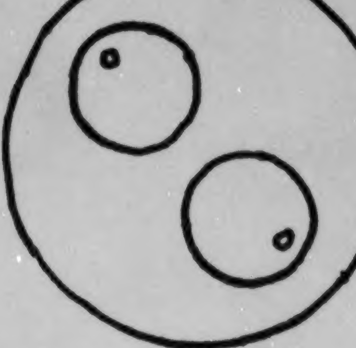
1. Lecture
   a) Define terms
   b) Refer to chart on composition of air
   c) Refer to chart on chemical symbols and properties of mine gases
2. Drawing
   a) Students will illustrate composition of mine gases

COMPOSITION OF AIR



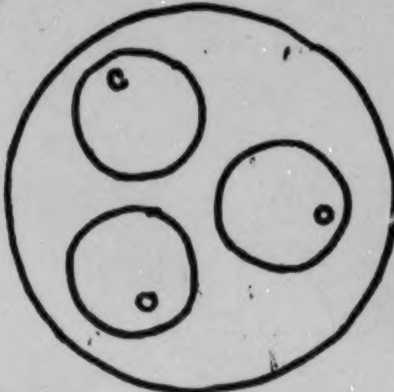
PROPERTIES OF MINE GASES

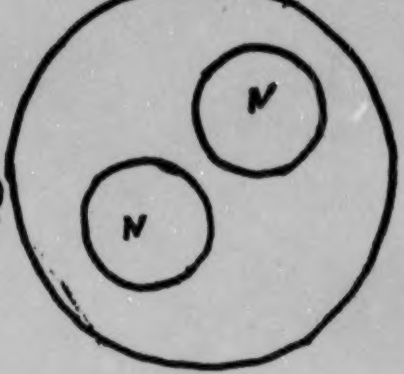
NAME OF GAS	CHEMICAL SYMBOL	SPECIFIC GRAVITY	SOURCE	EFFECT ON LIFE	EXPLOSIVE RANGE PER CENT BY VOLUME	MOST VIOLENT EXPLOSIVE PERCENTAGE (in air)	LOWEST IGNITION TEMPERATURES	PERCENTAGES DANGEROUS IN 30 TO 60 MINUTES	HOW DETECTED
AIR (MIXTURE)	...	1.000	The atmosphere	Supports life...	None	...	....	....	....
OXYGEN	O_2	1.105	Constitutes approximately one-fifth of the atmosphere	Supports life...	None	...	....	....	Safety lam O_2 Detecto
METHANE	CH_4	.555	Emanations from coal and carbonaceous shales.	Inert...	5%- 15%	100%	1200°F	....	Safety lam Methane Detectors
CARBON DIOXIDE	CO_2	1.529	Oxidation of coal, blasting mine fires, explosions, breathing, decay, chemical action of acid waters.	Poisonous in quantities.	None	...	....	8%	Analysis.. Detectors
CARBON MONOXIDE	CO	.967	Incomplete, combustion, mine fires, explosions and blasting.	Poisonous	12.5% 74%	32%- 36%	1190°F	0.2%	CO Detecto
NITROGEN	N_2	.967	Constitutes approximately four-fifths of the atmosphere.	Inert...	None	...	....	....	Analysis
HYDROGEN SULPHIDE	H_2S	1.191	Explosions, mine fires, blasting, and occasionally from water in which it has been dissolved.	Poisonous	4.3% 46%	14%	655°F	0.05%	Odor, Hydrogen Sulphi Detector
NITROGEN DIOXIDE	NO_2	1.589	By burning of high explosives.	Poisonous	None	...	....	0.01%	Odor, NO_2 Detector
SULPHUR DIOXIDE	SO_2	2.263	By burning pyrites or other sulphur bearing material.	Poisonous	None	...	....	0.05%	Odor. SO_2 Detector
HYDROGEN	H_2	.070	Charging of batteries, mine fires, explosions	Inert	4.1%	32%-	935°F	....	Analysis..



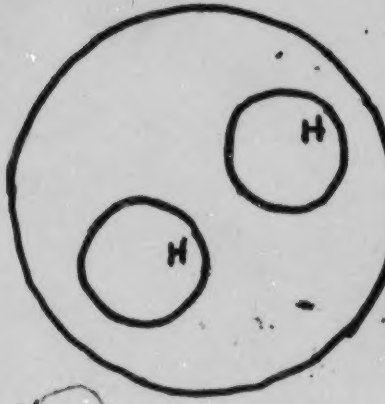
Oxygen (O_2)

Carbon Dioxide (CO_2)

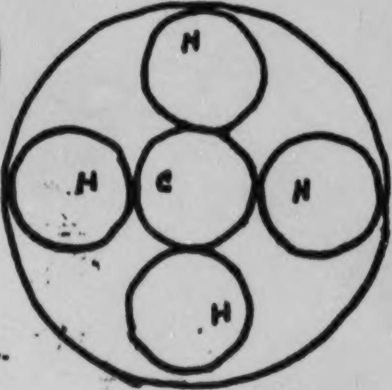




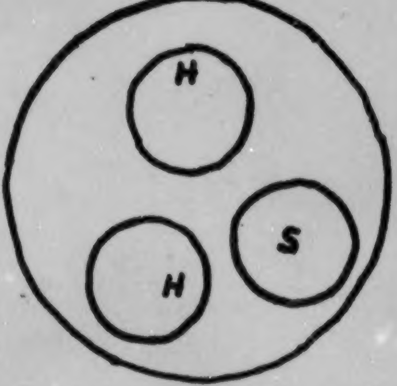
Nitrogen (N_2)



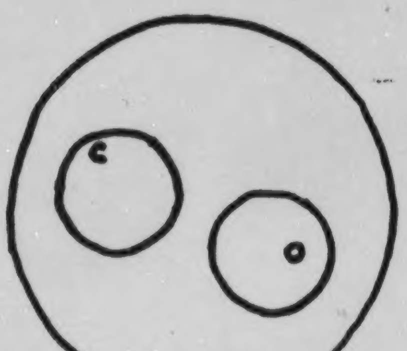
Hydrogen (H_2)



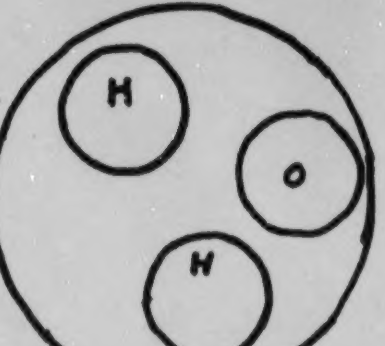
Methane (CH_4)



Hydrogen Sulphide (H_2S)



Carbon Monoxide (CO)



Water Vapor (H_2O)

MINE GASES

Physics of Gases

OBJECTIVES:

1. Given definitions of terms that relate to the physics of gas, the student will be able to apply these terms in solving problems related to the behavior of gases and mixtures of gases.
   atmospheric pressure   atmosphere   absolute pressure
   barometer   absolute zero   absolute temperature

2. Given information on the effects of pressure, temperature, an volume of mine air, the student will be able to explain the use of a barometer in determining air pressure.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 194-196.

2. Coal Mining Reference Book - Pages 2, 48, 50.

PRESENTATION AND ACTIVITIES:

1. Lecture - Discussion.
   a) Definition of terms
   b) Sea level pressure 14.7 pounds per square inch
   c) Pressure of the atmosphere decreases with the elevation of any place above sea level and increases with the distance below it.
   d) Use of barometer in determining absolute pressure, and absolute temperature.

MINE GASES

Properties, Characteristics, and Detection of Mine Gases
(Hydrogen - Oxygen - Nitrogen)

OBJECTIVES:

1. The student will be able to state under what conditions hydrogen is found in the mines.
2. The student will be able to state how health and safety can be affected by gases found in the mines.
3. The student will be able to name the two main gases in normal air.
4. The student will be able to identify two ways the air can lose oxygen in the mine.
5. The student will be able to identify the person responsible for making oxygen defieciency tests and where and when to make the tests.
6. The student will be able to distinguish between a "certified" person and a "qualified person".
7. The student will be able to describe the procedure to be followed if a miner encounters less than 19.5% oxygen.
8. The student will become familiar with federal and state laws regarding mine gases.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 196, 203-204.
2. Code of Federal Regulations, July 1, 1978, Revised Edition, Subpart D, 75.303, 75.301, 75.307, 75.308, 75.309, 75.307-1.
3. MSHA Circular, "Mine Gases" - Pages 2-9.
4. Coal Mining Reference Book - Pages 4,15.

PRESENTATION AND ACTIVITIES:

1. Lecture
   a) Refer to consumption of oxygen and oxygen deficiency.
2. Discussion
3. Assigned readings

APPROXIMATE RATE AND VOLUME OF RESPIRATION AND OF OXYGEN CONSUMPTION BY HUMANS

Degree of Activity	Respiration Per Minute	Air Inhaled Per Respiration (Cubic Inches)	Air Inhaled Per Minute (Cubic Inches)	Oxygen Consumed Per Minute (Cubic Inches)
At Rest	16	30	480	20
Moderate Exercise	30	100	3000	120
Vigorous Exercise	40	150	6000	240

EFFECTS OF OXYGEN DEFICIENCY

Oxygen Present	Effect
21%	Breathing easiest
19.5%	Minimum requirement by law
19%	Flame safety lamp gives about one-third the light it gives in normal air (if the atmosphere is methane free).
17%	Breathing becomes faster and deeper.
16.25%	Flame safety lamp extinguishes in a methane-free atmosphere
16-13%	Dizziness, buzzing noise, rapid pulse, headache, blurred vision.
12.1%	Flame safety lamp extinquishes
9%	May faint or become unconscious
6%	Movement convulsive, breathing stops, shortly after, the heart stops

MINE GASES

Carbon Monoxide, Hydrogen Sulfide, Carbon Dioxide

OBJECTIVES:

1. The student will be able to determine the correct procedures and instruments used in the detection of carbon monoxide, hydrogen sulfide, and carbon dioxide.

2. The student will become aware that he/she can detect some gases through his/her senses.

RESOURCES:

1. MSHA Slides - "M.S.A. Carbon Monoxide Tester".

2. Text - Elements of Practical Coal MIning" - Pages 201-205.

3. MSHA Program Instruction Workbook - "Mine Gases" - Pages 27-49.

4. Coal Mining Reference Book - Pages 53-55.

PRESENTATION AND ACTIVITIES:

1. Instructor will bring in a carbon monoxide indicator, hydrogen sulfide detector, and demonstrate their use to the class.

2. View slides, followed by classroom discussion.

MINE GASES

Methane

OBJECTIVES:

1. The student will be able to describe the characteristics and physical properties of methane.
2. The student will be able to describe the procedure to be followed if a miner encounters one per cent (1%) or more of methane in the mine.
3. The student will be able to identify the person responsible for testing for methane and where and when this is done.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 197-199.
2. Kentucky Mine Safety Training Program. Slides and tapes.
   "Methane" 13-1
   "Methane Testing Responsibilities" 13-4
3. MSHA Circular - "Mine Gases" - Pages 11-12.
4. Coal Mining Reference Book - Pages 5-7.
5. Code of Federal Regulations - July 1, 1978, Revised Edition, Subpart D, 75.307, 75.308, 75.309, 75.307-1.

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Students in simulated activity of encountering methane in the mine.
3. Slides - cassettes.
4. Discussion.
5. Assigned readings.

MINE GASES

Detection of Methane (Flame Safety Lamp)

OBJECTIVES:

1. Given a flame safety lamp, the student will be able to identify the various parts of the lamp and describe their functions.
2. Given a flame safety lamp, the student will demonstrate his/her ability to disassemble and reassemble the lamp properly.
3. Given a flame safety lamp, the student will demonstrate the proper method of testing for methane.
4. The student will be able to state the limitations of the flame safety lamp.

RESOURCES:

1. Text - Elements of Practical Coal Mining; Pages 188, 198-199, 228.
2. Code of Federal Regulations, July 1, 1978, Revised Edition, Subpart D, 75.310-2.
3. MSHA - "Koehler and Wolf Permissable Flame Safety Lamp" - Revised, April 1976.
4. Kentucky Mine Safety Training Program - Slides and Casettes "Flame Safety Lamp" 13-3
5. MSHA - Transparencies- "Koehler and Wolf Permissable Flame Safety Lamp"
6. Coal Mining Reference Book - Pages 39-48.

PRESENTATION AND ACTIVITIES:

1. Demonstration
2. Disassemble and reassemble safety lamp
3. Transparencies
4. Slide cassette
5. Assigned readings

MINE GASES

Detection of Methane
(Permissable Methanometer)

OBJECTIVES:

1. Given proper instruction and a G-70 Permissable Methanometer, the student will be able to perform preliminary instrument checks.
2. The student will be able to use the instrument properly and obtain accurate readings.
3. The student will obtain specific information concerning the various parts.
4. The student will be able to state the proper maintenance requirements for the methanometer.

RESOURCES:

1. MSHA - Instructor Guide - "G-70 Permissable Methanometer".
2. MSHA - Transparencies - "Permissable Methanometer, G-70".

PRESENTATION AND ACTIVITIES:

1. Lecture - Transparencies.
2. Demonstration - The instructor and students will construct a methane testing box. This box will be so constructed, that the students will be able to test for gas by using a probe attached to the methanometer.

MINE GASES

Breathing Apparatus (Self-Rescuer)

OBJECTIVES:

1. The student will be able to state three important state and federal regulations that relate to the self-rescuer.
2. The student will describe situations in which the self-rescuer should be used.
3. The student will be able to state the principal purpose of the self-rescuer.
4. The student will be able to list several major parts of the self-rescuer.
5. The student will demonstrate with proficiency how to put on the self-rescuer.
6. The student will explain how to test and maintain the self-rescuer.

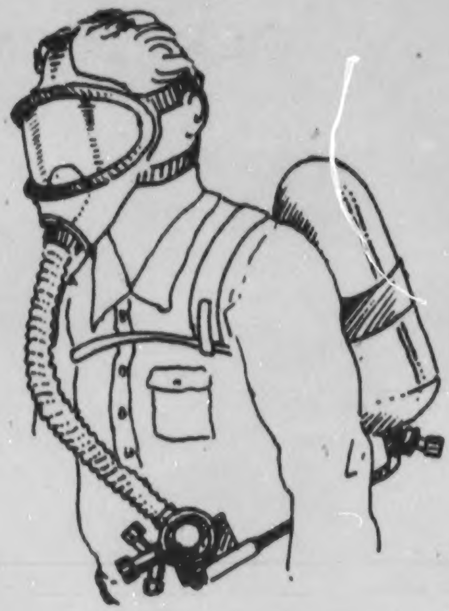
RESOURCES:

1. Text - Elements of Practical Coal Mining - Page 222.
2. Coal Mining Reference Book - Pages 57-59.
3. MSHA Circular - "Drager 810 Self-Rescuer".
4. MSHA Circular - "M.S.A.W-65 Self-Rescuer".
5. Kentucky Mine Safety Training Program - Slides - Cassettes.
   "Introduction to a Self-Rescuer" - 1-1.
   "Use of a Self-Rescuer" 1-2.
6. Code of Federal Regulations, July 1978, Revised Edition, Subpart R - 75.1714, 75.1714-1, 75.1714-2.

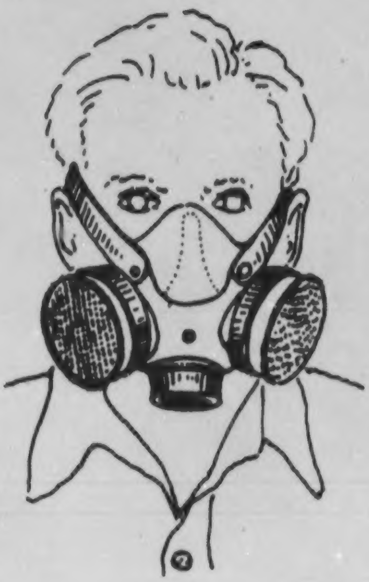
PRESENTATION AND ACTIVITIES:

1. Slides - cassette.
2. Pictures - diagrams.
3. Assigned readings.
4. Demonstration - Each student will demonstrate the use of the self-rescuer.
5. Students paired - one to one - put on self-rescuer.
6. Timed test.

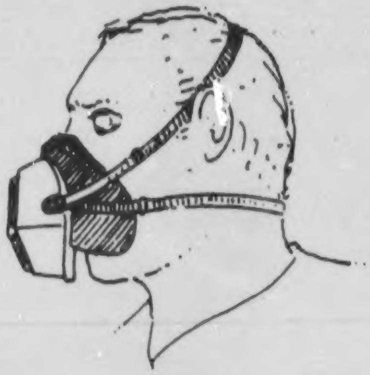
Types of Respirators



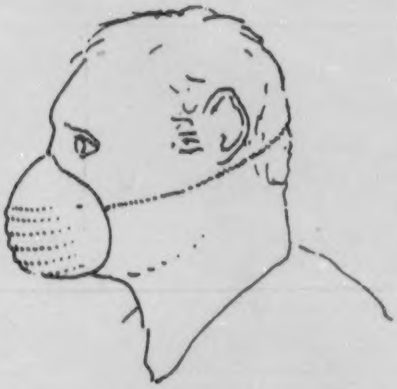
SUPPLIED AIR TYPE



CARTRIDGE TYPE

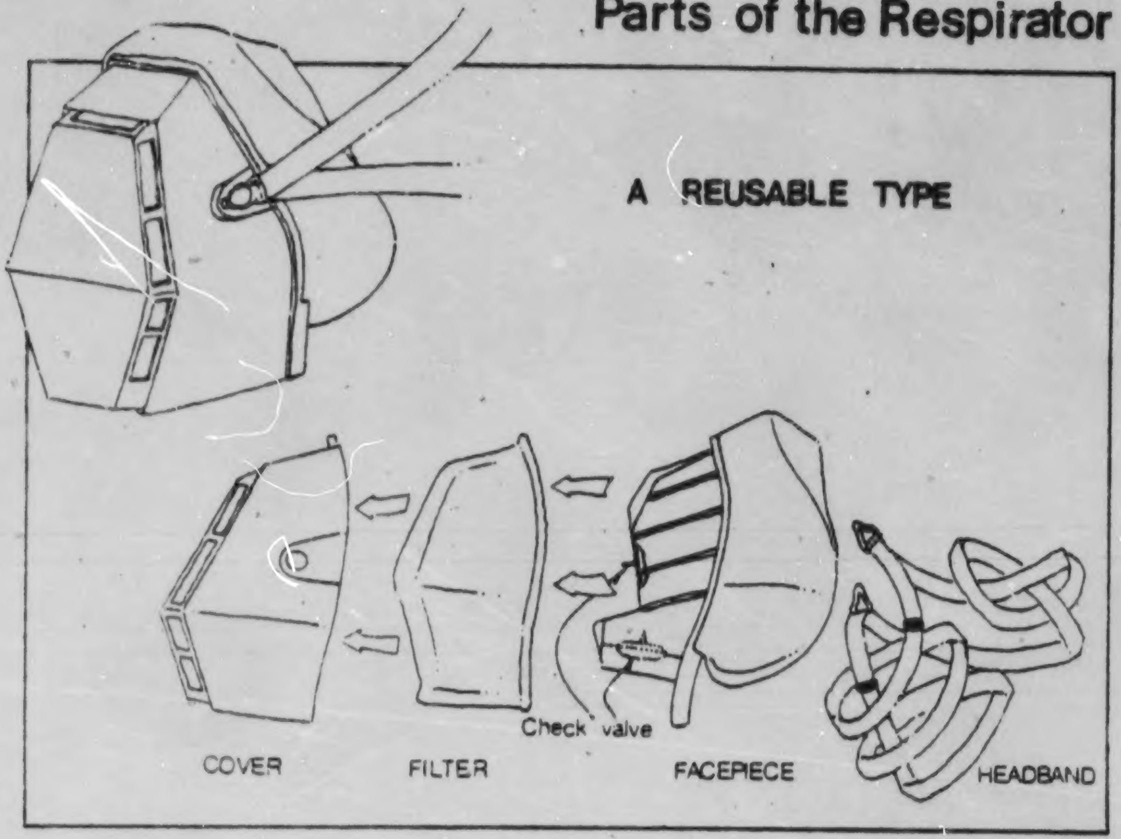


REUSABLE
PARTICULATE
TYPE



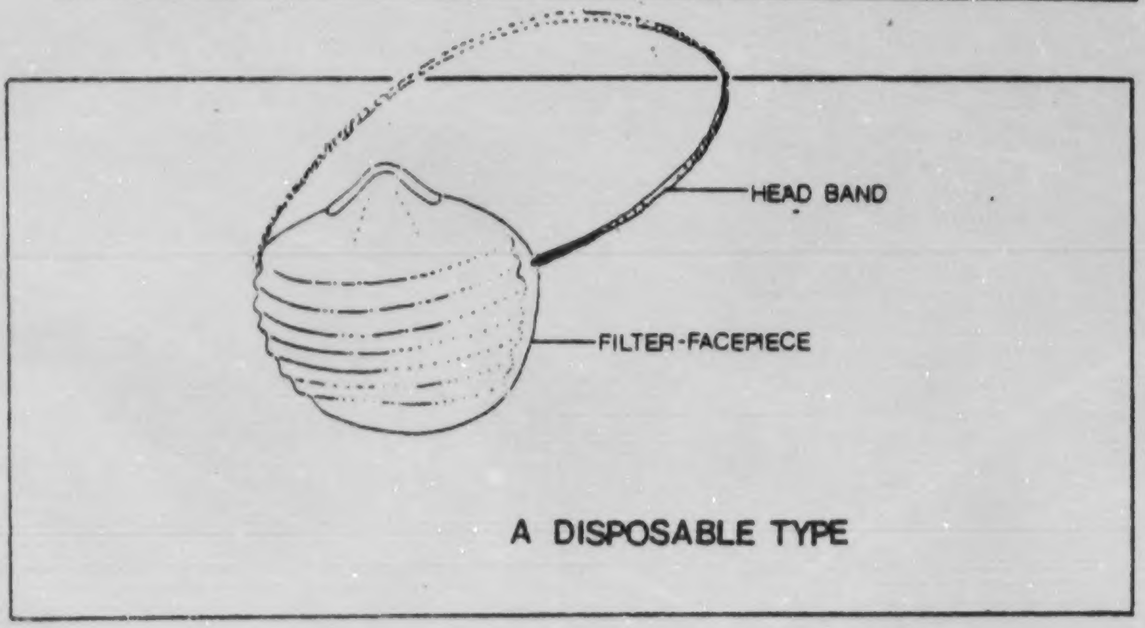
DISPOSABLE
PARTICULATE
TYPE

Parts of the Respirator



A REUSABLE TYPE

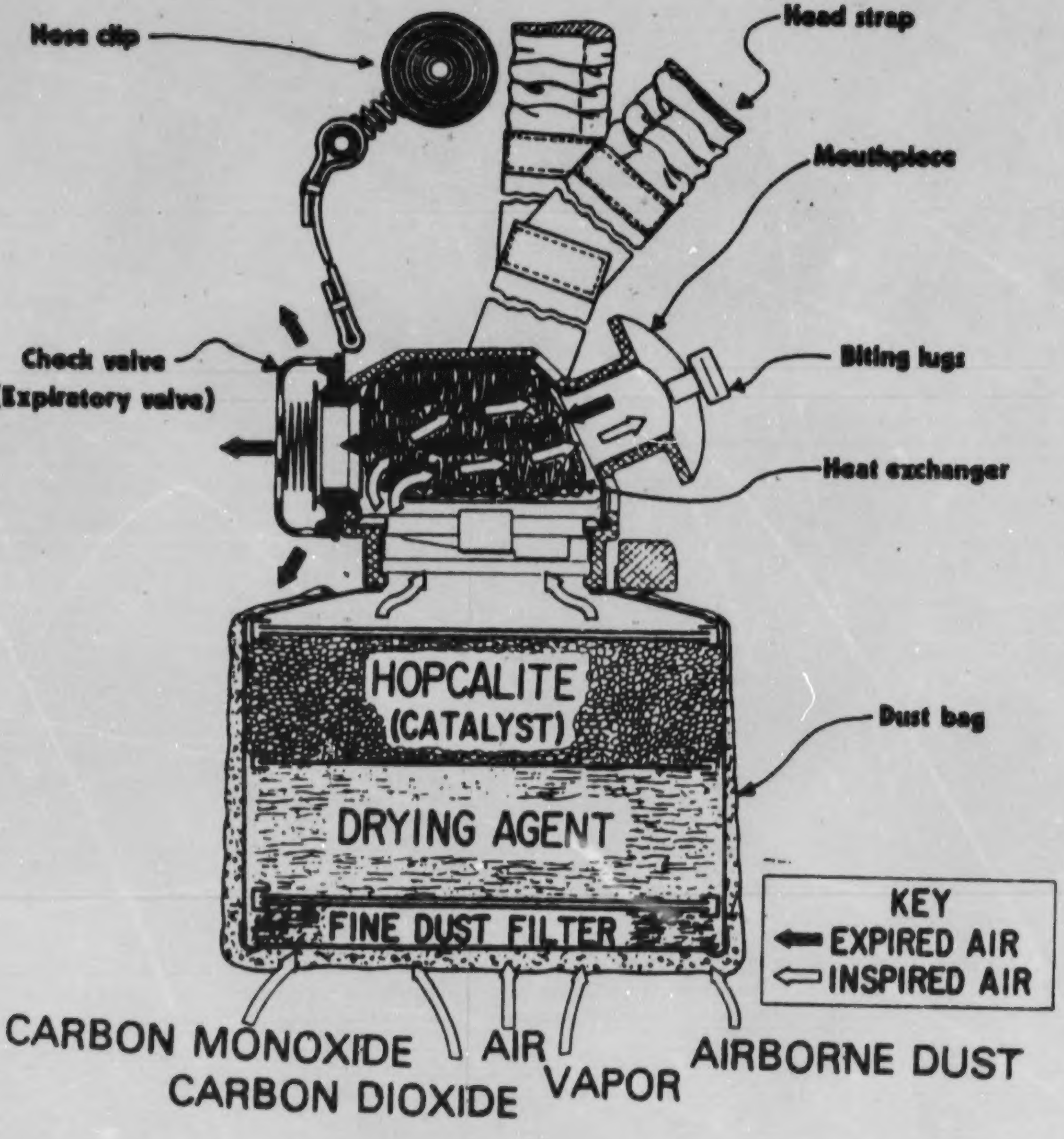
Check valve
COVER
FILTER
FACEPIECE
HEADBAND



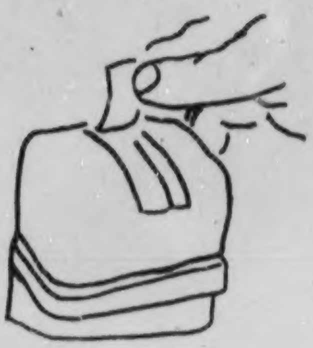
A DISPOSABLE TYPE

HEAD BAND
FILTER-FACEPIECE

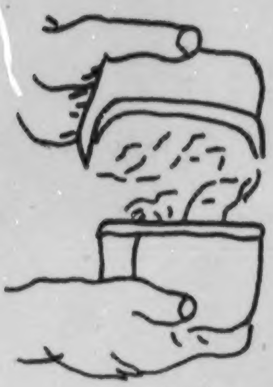
Self-rescuer (cutaway view)


Nose clip
Head strap
Mouthpiece
Check valve
(Expiratory valve)
Biting lugs
Heat exchanger
HOPCALITE
(CATALYST)
Dust bag
DRYING AGENT
FINE DUST FILTER
KEY
EXPIRED AIR
INSPIRED AIR
CARBON MONOXIDE
CARBON DIOXIDE
AIR
VAPOR
AIRBORNE DUST

(1)



(2)



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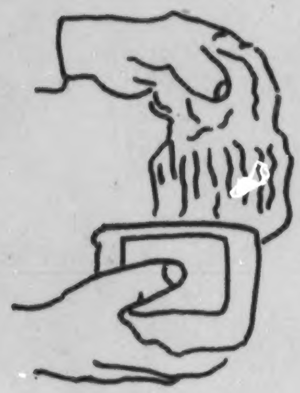

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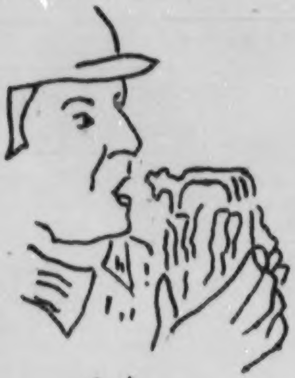

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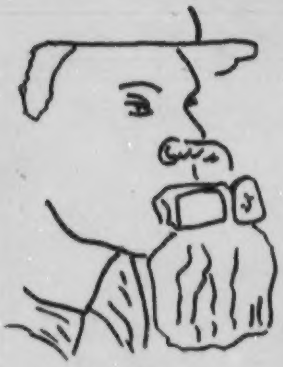

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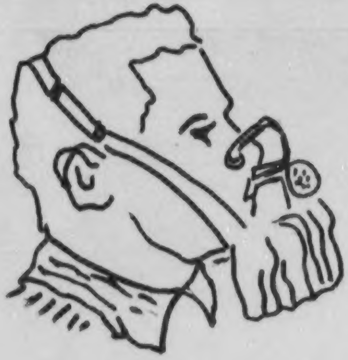
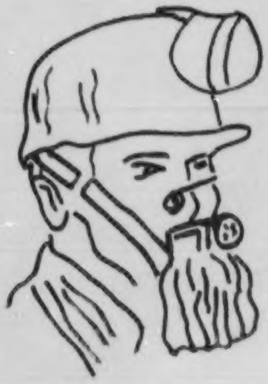


(7)



Steps For Putting On Self-Rescuer:

1. Lift seal, pull back.
2. Remove top.
3. Lift bag out of bottom.
4. Insert mouthpiece.
5. Adjust nose clamps.
6. Place strap around your head.
7. Put on cap.

MINE GASES

Breathing Apparatus
(All Service Gas Mask)

OBJECTIVES:

1. The student will gain knowledge of what type of gas mask is used in irrespirable mine atmospheres.
2. The student will compare the appearance of the all service gas mask with that of the self-rescuer.
3. The student will be knowledgeable about the chemicals and the way they are used in the approved canister of the all service gas mask.
4. The student will be able to determine the limitations of the all service gas mask.

RESOURCES:

1. Bureau of Mines Circular 35, "Protection Against Mine Gases".
2. Coal Mine Reference Book - Pages 59-61.

PRESENTATION AND ACTIVITIES:

1. Diagrams - All service gas mask parts.
2. Demonstration - The instructor will bring an all service gas mask to class and explain its operation.
3. Assigned readings.

MINE GASES

Breathing Apparatus
(Self-contained Oxygen Breathing Apparatus)
Drager, McCaa, Chemox

OBJECTIVES:

1. The student will define and list the major parts of a self-contained oxygen breathing apparatus.
2. The student will be able to state the general principle of the Drager Self-Contained Oxygen Breathing apparatus.
3. The student will be able to demonstrate proficiency in putting on the Drager Oxygen Breathing apparatus.
4. The student will be able to name the parts, and state the use of each, of the McCaa Oxygen Breathing Apparatus.
5. The student will be able to explain the operating principle of the Chemox Oxygen Breathing apparatus.
6. The student will be able to demonstrate with proficiency putting on the Chemox.
7. The student will be able to name the parts and use of each of the Chemox Oxygen Breathing apparatus.

RESOURCES:

1. Coal Mining Reference Book - Pages 62-65.

PRESENTATION AND ACTIVITIES:

1. Demonstration - Putting on Drager-Chemox Oxygen Breathing Apparatus.
2. Lecture and discussion.
3. Pictures - diagrams.

MINE GASES

Breathing Apparatus
(Dust Respirator)

OBJECTIVES:

1. The student will define "dust respirator".
2. The student will identify who will wear a dust respirator and under what conditions.
3. The students will list the parts of a dust respirator.
4. The student will examine a dust respirator and demonstrate the proper way of wearing it.

RESOURCES:

1. Coal Mining Reference Book - Page 65.

PRESENTATION AND ACTIVITIES:

1. Lecture - The instructor will bring a dust respirator to class and explain its operation.
2. Demonstration - Putting on dust respirator.

GLOSSARY OF TERMS (Mine Gases)

Absolute pressure. Any pressure above that of a perfect vacuum is known as absolute pressure.

Absolute zero. The temperature at which a gas would show no pressure if the general law for gases would hold for all temperatures.

Absolute temperature. The thermometer reading plus 460°.

Afterdamp. The mixture of gases which remain in a mine after a mine fire or an explosion of firedamp. It consists of carbonic acid gas, water vapor (quickly condensed) nitrogen, Oxygen, carbon monoxide and in some cases, free hydrogen, but usually consists principally of carbonic acid gas and nitrogen and is therefore irrespirable.

Asphyxiate. To suffocate or choke.

Atmospheric pressure. The pressure of the air upon an object on the surface of the earth is equal to the weight of the column of air extending from the object to the upper limits of the atmosphere, a distance variously estimated as up to 200 miles. The pressure of the atmosphere decreases with the elevation of any place above sea level and increases with the distance below it.

Atom. Smallest particle of an element that can enter into chemical reaction. Atoms unite to form molecules.

Barometer. An instrument for measuring atmospheric pressure.

Barricade. Asphyxiating gases are formed when there has been a fire in any mine or an explosion in a coal mine. If men are unable to escape, they should retreat as far as possible, select some working place with plenty of space, short circuit the air from this place, build a light barricade or stopping and remain behind it until rescued.

Carbon dioxide. Heavy, colorless, irrespirable gas (CO_2) it extinguishes a flame. It is formed in mine explosions and in mine fires and forms part of the afterdamp.

Carbon monoxide. Colorless, odorless, very toxic gas (CO) that is formed as a product of the incomplete combustion of carbon. This gas is formed during mine fires and after explosions; in automobile exhaust and gas stoves.

CFR. Code of federal regulations.

Chemical compound. A mass of matter made up of the same kind of molecules but the molecules are composed of two or more atoms of different elements.

Chemical symbol. Letters of an element and the numbers of each atom of the element forming a molecule.

Combustion. The action of operation of burning.

Continuous mining. Mining in which the continuous mining machine cuts or rips coal from the face and loads it onto conveyors or into shuttle cars in a continuous operation. Thus, the drilling and shooting operations are eliminated.

Conventional mining. The cycle of operations which includes cutting the coal, drilling the shot holes, charging and shooting the holes, loading the broken coal and installing roof support.

Crosscut. A passageway that connects parallel entries or different seams in a mine.

Diatomic. Consisting of two atoms; having two atoms in the molecules.

Diffusion. Gradual mixing or blending of two or more gases that come in contact with each other.

Element. A mass of matter composed of the same kind of molecules, which in turn, are composed of the same kind of atoms.

Face. An area in a coal mine where coal is being extracted from its natural deposit in the earth. The face is formed during the mining cycle.

Flame safety lamp. A lamp, the flame of which is so protected that it will not immediately ignite firedamp. Originally developed by Sir Humphrey Davey in 1815. The flame is generally surrounded by a cylindrical covering of wire gauze. An explosive or flammable mixture of gas entering the lamp will be ignited by the flame, but the flame of combustion will not pass through the coal gauze and ignite the gas outside the lamp.

Hydrogen. A colorless, odorless, liquid gas. (H_2)

Hydrogen sulfide. A poisonous, combustible, colorless gas having a sweetish taste and an odor like rotten eggs. In the old days, was known as "stinkdamp". (H_2S)

Inby. Toward the working face or interior of the mine, away from the shaft or entrance.

Mass. A number of like molecules grouped together.

Methane. A colorless, odorless, liquid gas, and the most common explosive gas in mines. (CH_2)

Mixture. A mass of matter composed of two or more different kinds of molecules.

Molecule. Smallest size of matter that may be divided by simple physical means and is the smallest particle of matter that is capable of separate existence.

Nitrogen. A tasteless, odorless and colorless gas which neither support life nor combustion. (N_2)

Oxygen. A tasteless, odorless, and colorless gas which supports life and combustion. (O_2)

Room. An underground area in which coal is mined.

Specific gravity. (sp gr) in the study of mine gases, is the relationship by weight of a volume of gas to a like volume of air under the same pressure and temperature conditions.

Water vapor. Water in a gaseous state. (H_2O)

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VENTILATION AND DUST CONTROL

Ventilation

- I. INTRODUCTION
- II. TYPES OF SURFACE FANS
  - A. Centrifugal
  - B. Propeller
  - C. Low Pressure Disk
- III. TYPES OF VENTILATING SYSTEMS
  - A. Exhaust Method
  - B. Blowing Method
- IV. VENTILATION CONTROL DEVICES
  - A. Purpose and Construction
    - 1. Stoppings
    - 2. Overcasts
    - 3. Regulators
    - 4. Doors
    - 5. Line Brattice
    - 6. Check Curtains
    - 7. Auxiliary Fans and Tubing
    - 8. Bleeders and Bleeder Systems
- V. DUST CONTROL
  - A. The Need For Coal Dust Control
    - 1. Coal Dust Terms
  - B. Rock Dusting
    - 1. Application of Rock Dust
      - a. Trickle duster
      - b. Mobile rock duster
      - c. Hand spreading
- VI. MSHA AND THE KENTUCKY DEPARTMENT OF MINES AND MINERALS COAL MINE VENTILATION AND DUST CONTROL LAWS
  - A. MSHA's Ventilation and Dust Control Laws
    - 1. "Code of Federal Regulation" - subpart D - ventilation, 75.300 - 75.404 pages 436-455 - July 1, 1978 edition.
  - B. Kentucky Department of Mines and Minerals Ventilation and Dust Control Laws
    - 1. "Laws Governing the Mining of Coal and Clays" - Kentucky Revised Status - Chapter 352.020, 352.030, 352.040, and 352.060 - Amended 1976 edition.
- VII. CONTROL OF VENTILATION IN UNDERGROUND COAL MINES
  - A. Using a 4' x 8' Working Model of a Mine
    - 1. Control devices
    - 2. Ventilating routes
    - 3. Ventilating currents

VIII. VENTILATING A MINE USING A MAP
  A. Use of Control Devices
  B. Ventilation Routes
  C. Direction of Ventilating Currents
  D. Students Ventilating a Seven Section Mine Map Using the Split System

IX. VENTILATING INSTRUMENTS
  A. Anemometer
    1. Purpose
    2. Nomenclature
    3. Use by students
  B. Barometer
    1. Purpose and use
  C. Water and Recording Gauges
    1. Purpose and use

X. FUNDAMENTAL VENTILATION FORMULAS
  A. Quantity of Air
  B. Pressure Per Square Foot
  C. Total Pressure
  D. Rubbing Surface
  E. Resistance
  F. Total Pressure
  G. Horsepower

XI. FIELD TRIP TO OBSERVE AN OUTSIDE MINE FAN AND AN UNDERGROUND COAL MINE VENTILATING SYSTEM

VENTILATION

Introdution - Types of Surface Fans, Types of Ventilating Systems

OBJECTIVES:

1. The student will recognize the terms below and understand their function in movement of air into and out of the mine. 1) main fans 2) exhaust fans 3) blow fans 4) intake 5) return 6) air split

2. The student will describe the general legal requirements regarding a ventilation plan and the three purposes of mine ventilation: oxygen supply, dangerous gas control, dust control.

3. The student will identify three types of fans that can be used: centrifugal, propeller, low disk.

4. The student will compare the operation of an exhaust ventilating system and a blowing ventilating system.

5. The student will become acquainted with mine map symbols, and will be able to recognize the symbol representing fans.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 206-210.

2. Coal Mining Reference Book. Pages 28-31.

3. Code of Federal Regulations, July 1978, Revised Edition, Subpart D, 75.300, 75.300-1, 75.330-2, 75.300-3.

4. MSHA - Circular "Ventilation" - Pages 3-7.

5. Kentucky Mine Safety Training Program - Slide - Cassette "Introduction to Coal Mine Ventilation and Terms" 6V-1 "How Coal Mines are Ventilated" 6V-2

PRESENTATION AND ACTIVITIES:

1. Federal laws regarding ventilation will be read and discussed.

2. Instructor will list on chalkboard all responses from students on purposes of ventilation.

3. A lecture on the blowing and exhaust ventilation systems will be made by instructor. A hand-out on these two sytems will be given to the students.

4. Hand-outs of mine map symbols will be given to the students. Attention will be called to the symbol representing fans.

5. View slides and discuss terms that are used in this lesson and also those in subsequent lessons.

VENTILATION

Ventilation Control Devices

OBJECTIVES:

1. The student will recognize and understand the terms below and their function in directing and controlling the ventilating air:
   a) stoppings b) overcasts c) regulators d) doors e) line brattice f) check curtain g) auxillary fans and tubing h) bleeders and bleeder systems

2. Given a simplified map the student will label each of the following: a) intake air b) return air c) air split d) regulator 3) overcast f) undercast g) belt H) tract i) permanent stopping j) escapeway k) curtain l) door

RESOURCES:

1. Kentucky Mine Safety Training Program - Slides and Cassette
   "Control of Ventilating Air" 6V-3
   "Ventilation at the Working Face" 6V-4
   "Check Curtain Construction and Safety" 6V-5
   "Mine Maps and Legends" 6V-7

2. MSHA Film - "Face Ventilation in Underground Coal Mines"

3. MSHA Circular "Ventilation" Pages 10-23.

4. Coal Mining Reference Book - Pages 23-28.

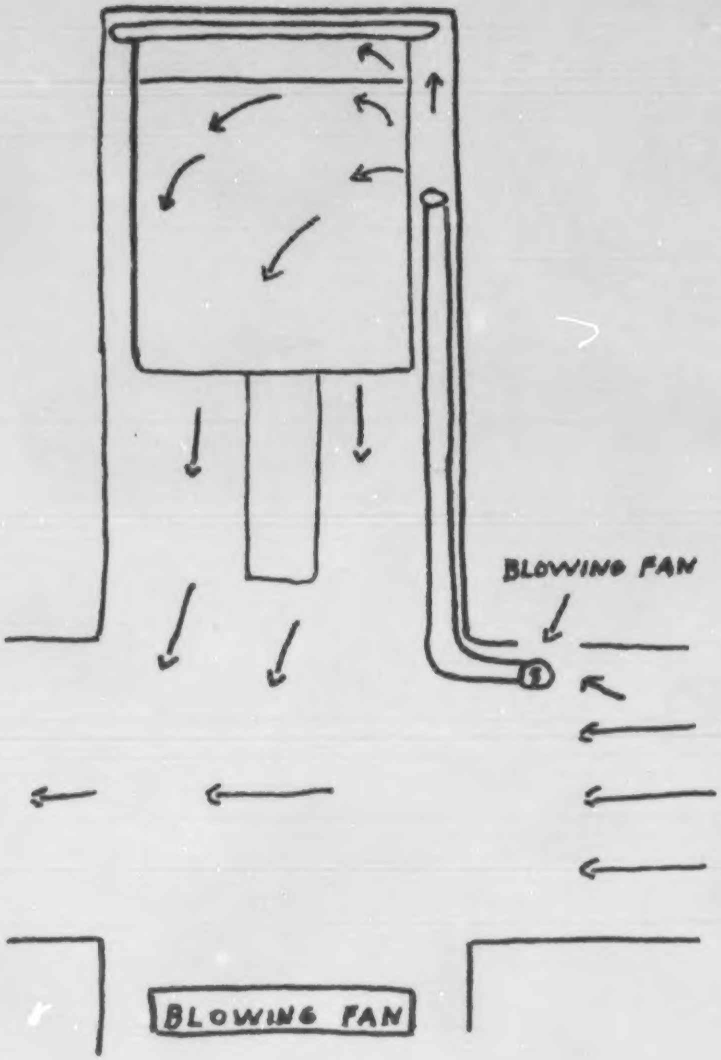
5. Text - Elements of Practical Coal Mining - Pages 212-200.

PRESENTATIONS AND ACTIVITIES:

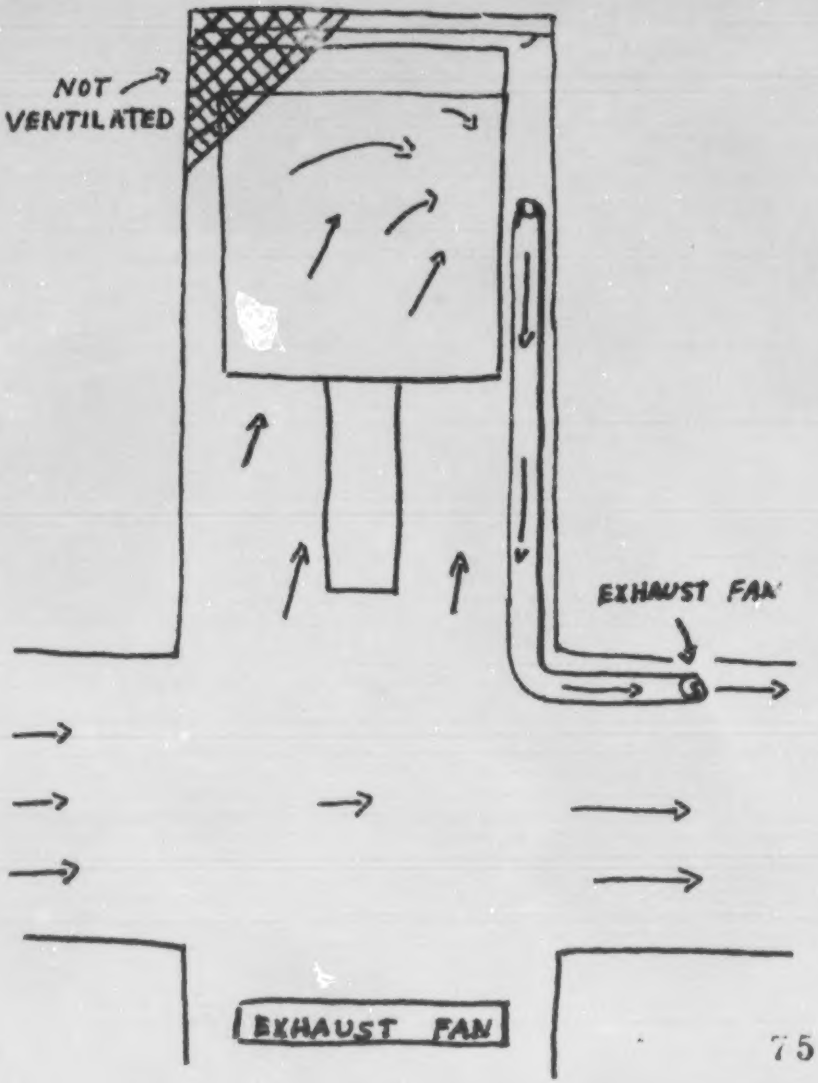
1. The students will be given a ventilation map showing each of the control devices listed above. (This is the system used in one of the local mines.) A thorough discussion of the purpose and use of each will be held.

2. The instructor will use an overhead projector in showing diagrams of control devices.

3. Film and slides will be used to instruct and also to review control devices.

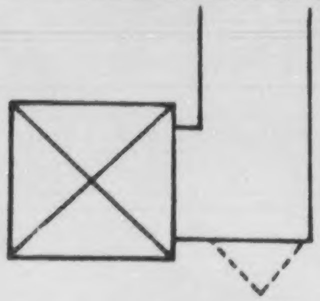

BLOWING FAN

BLOWING FAN

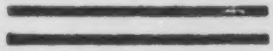

NOT VENTILATED
EXHAUST FAN

EXHAUST FAN

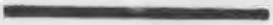
Mine Map Symbols



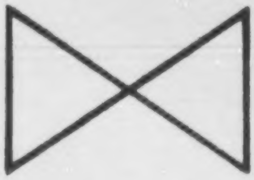
Fan



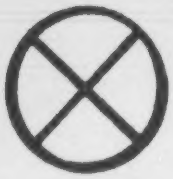
Permanent Stopping



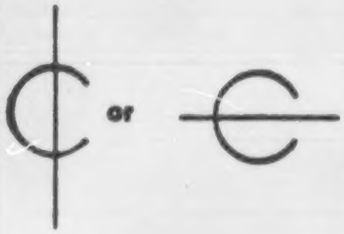
Temporary Stopping



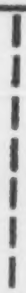
Overcast



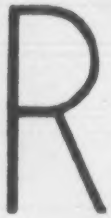
Undercast



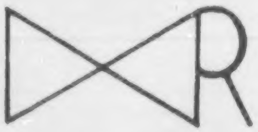
Check Curtain



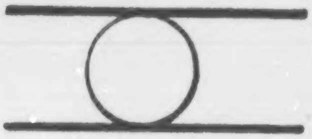
Line Brattice



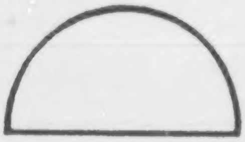
Regulator



Belt Regulator

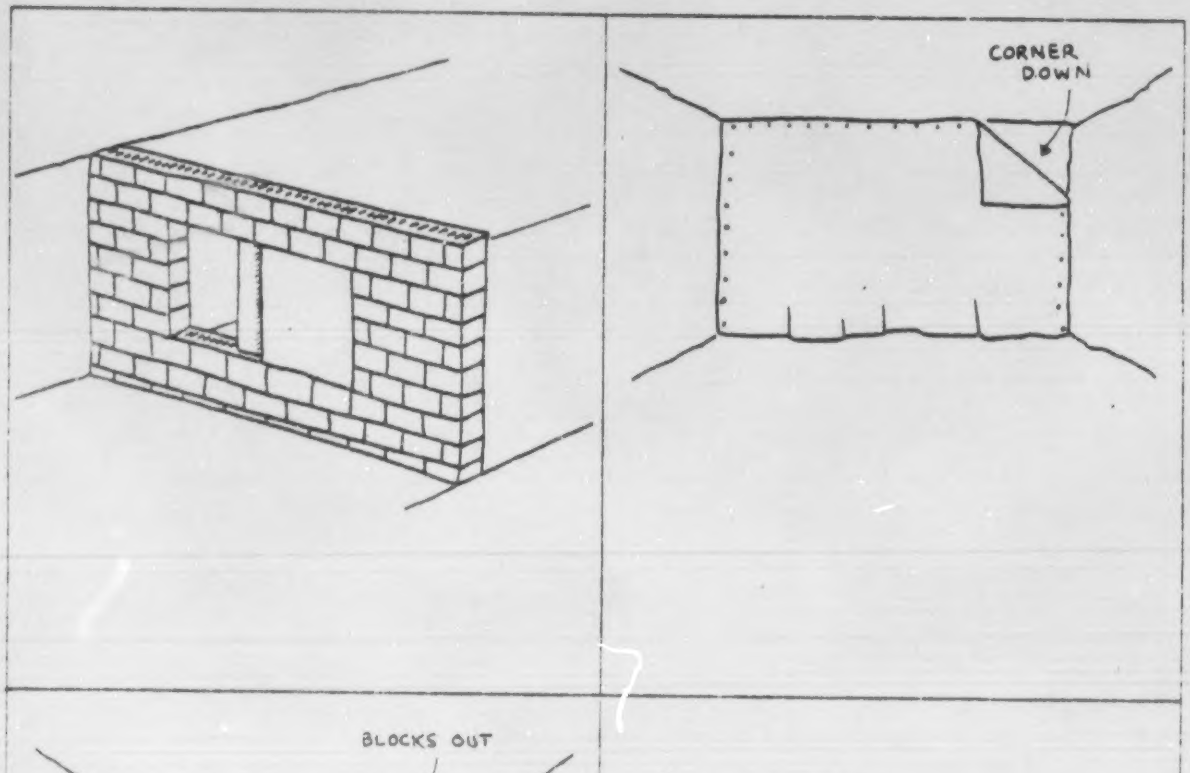


Box Check



Mine Door

Types of Regulators


CORNER DOWN
BLOCKS OUT
RETURN AIR

OVERCAST

An overcast is a form of a bridge which permits one air current to pass over another. Overcasts are normally built in an intersection opposite a break-through. (See Figures Number 1 and 2.) An overcast permits frequent splitting of the air allowing air to pass only over one section or one portion of mine. It also aids the haulage of a mine because it eliminates the necessity for a door on the haulage road. The most common errors made in the construction of an overcast are: rough and abrupt interruption to the ventilating current, and insufficient area. The area on the inside of the overcast which abuts up against the construction should be filled in with material and smoothed down so that air will flow easily over the top of the overcast. The distance from the top of the overcast to the roof should be of sufficient area to allow air to pass freely. (See Figure Number 3.)

OVERCAST

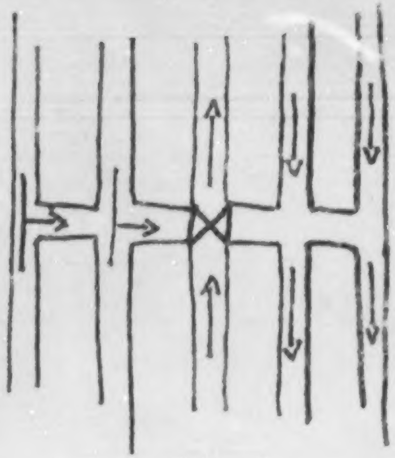


Fig. 2

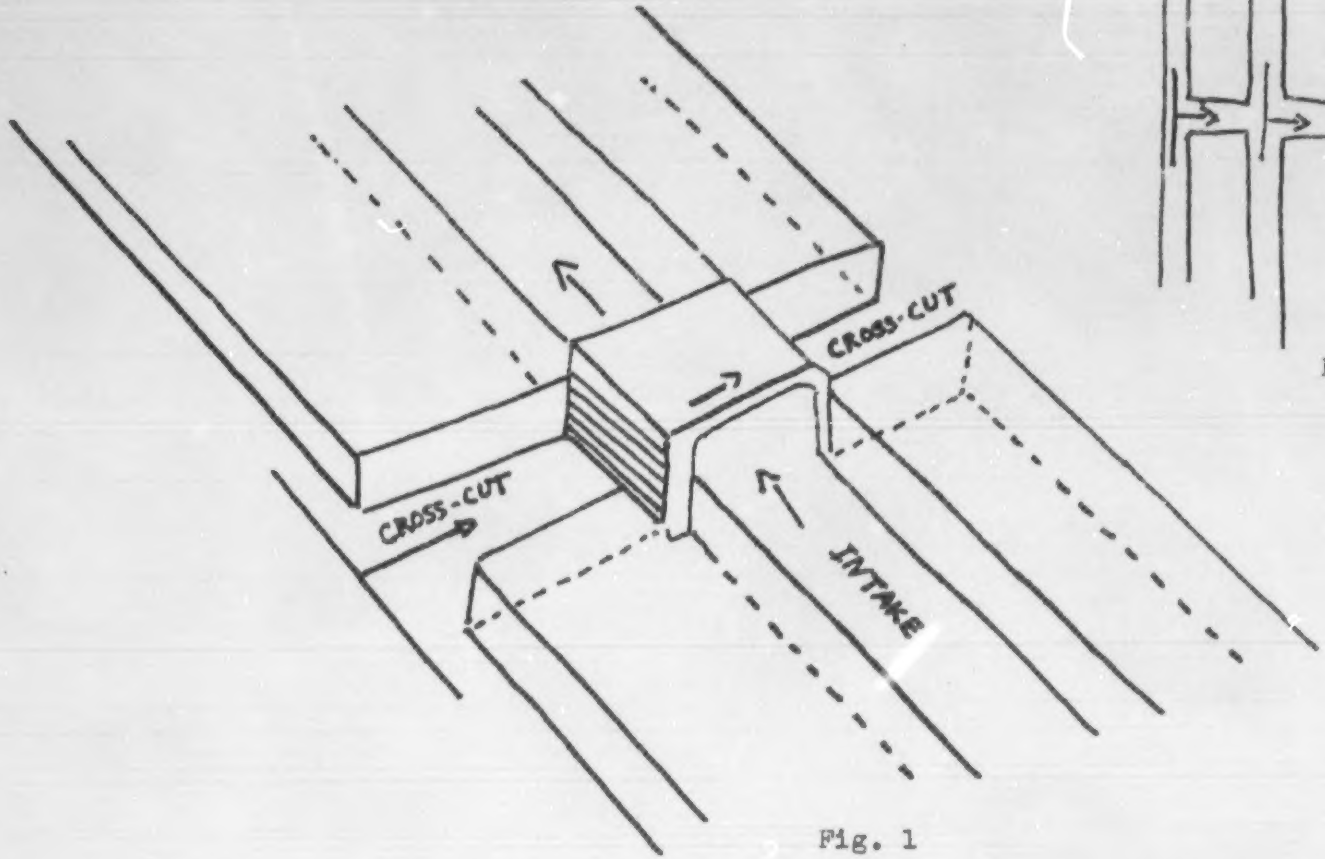

CROSS-CUT
CROSS-CUT
INTAKE

Fig. 1

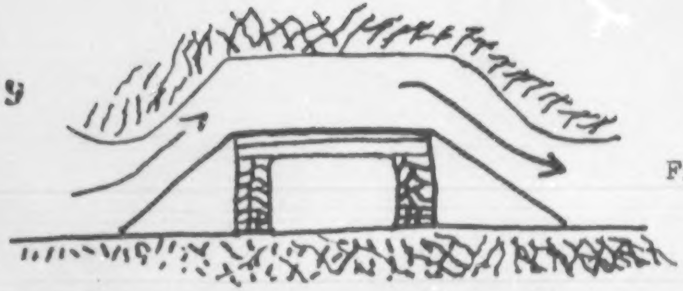


Fig. 3

VENTILATION

Dust Control

OBJECTIVES:

1. The student will explain the need for control of coal dust in the mine.
2. The student will describe some of the most current methods used in eliminating coal dust hazards.
3. The student will become familiar with federal laws relating to rock dusting.
4. The student will define rock dusting.
5. The student will explain the purpose of rock dusting and where and how it is applied.

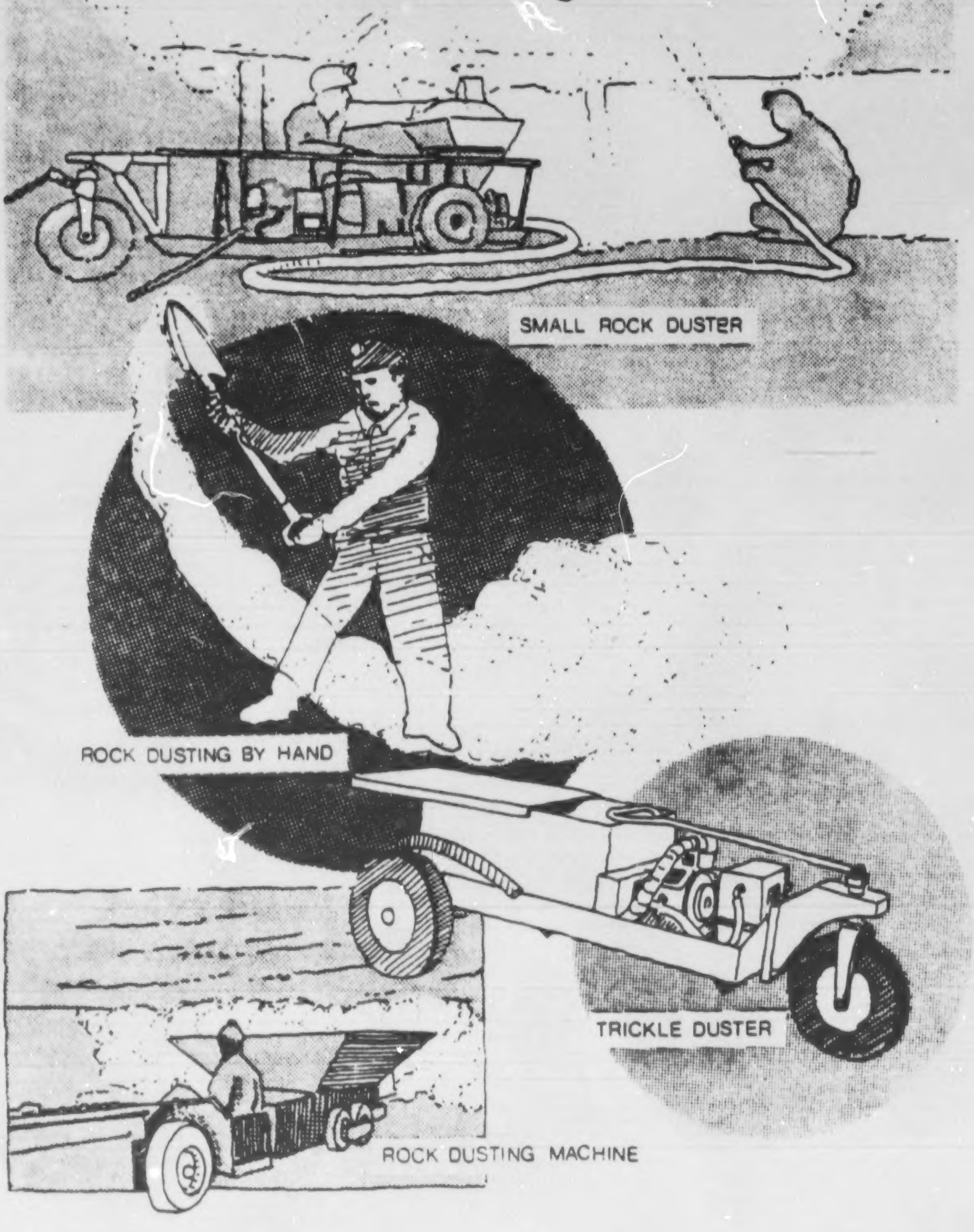
RESOURCES:

1. MSHA Circular " Clean Up and Rock Dusting" pages 8-11.
2. Coal Mining Reference Book - Pages 94-96.
3. Code of Federal Regulations - July, 1978, Revised Edition Subpart D, 75.300-75.404 - Pages 436-455.
4. Kentucky Department of Mines and Minerals- "Laws Governing the Mining of Coal and Clay". 1976, 352.020, 352.030, 352.040, 352.060.
5. Kentucky Mine Safety Training Program - Slides - Cassette "Rockdusting and Fire Protection" 7-1.

PRESENTATIONS AND ACTIVITIES:

1. Samples of rock dust will be brought in to class.
2. Experiment showing the explosibility of coal dust.
3. A hand-out will be given to the students depicting methods of rock dusting: small rock duster, rock dusting by hand, trickle duster, and mobile rock duster.
4. Disucssion of state and federal laws relating to dust control.
5. View slides on rock dusting; areas needed to be rock dusted, how rock dust extinquishes fires, how rock dust prevents fires, how to apply rock dust, and the percentage of rockdust that must be mixed with coal in different areas of the mine.

Rock Dusting



SMALL ROCK DUSTER

ROCK DUSTING BY HAND

TRICKLE DUSTER

ROCK DUSTING MACHINE

VENTILATION

Control of Ventilation in Underground Mines

OBJECTIVES:

1. The student will demonstrate his understanding of ventilation control devices by constructing a working model of a ventilating system showing control devices, ventilating currents, and ventilating routes.

RESOURCES:

1. Working model constructed by the instructor.

PRESENTATION AND ACTIVITIES:

1. The instructor will make a 4' by 8' working model of a mine ventilating system.
2. The instructor will lead the student step by step in constructing a working model on a smaller scale.

VENTILATION

Utilizing Instruments

OBJECTIVE:

1. Given an anemometer, the student will explain its purpose and how to obtain a reading.
2. Each student will obtain a reading by measuring the velocity of air current in the classroom and on the outside of the classroom.
3. Given two types of barometers, the student will explain their purpose and how to obtain a reading. a) mercurial barometer b) aneroid barometer
4. Each student will obtain a reading by measuring the atmospheric pressure with an aneroid barometer within the classroom and outside of the classroom.
5. The student will describe the purpose and operation of a water gauge.

RESOURCES:

1. Text - Elements of Practical Coal Mining
2. Coal Mining Reference Book - Pages 21, 48-52.

PRESENTATION AND ACTIVITIES:

1. Demonstration of the use of barometer, anemometer, and water gauge by the instructor.
2. Each student will examine an aneroid barometer, and an anemometer and obtain a reading from each.

VENTILATION

Fundamental Ventilation Formulas

OBJECTIVES:

1. The student will be able to solve problems relating to mine ventilation by applying certain basic fundamental formulas.

   $Q = AV$
   $p = 5.21$
   $P - pA$
   P - total pressure

   $S = LO$
   $R = KLOV^2$
   $P = R$
   $$Hp = \frac{PV}{33,000}$$

   $$i = \frac{P}{5.2}$$

   In which:
   A - Area of airway
   L - Length of airway
   O - Perimeter of airway
   p - Pressure in lbs. per sq. ft.
   P - Total pressure
   S - Rubbing surface

   i- Inches water gauge
   V- Velocity, ft. per min.
   Q- Quanity or volume
   Hp- Horsepower
   K- Coefficient of friction
   R- Resistance

RESOURCES:

1. Text - Elements of Practical Coal Mining.
2. Coal Mining Reference Book - Pages 34-37.

PRESENTATION AND ACTIVITIES:

1. A general math lesson will be taught on finding area, perimeter, length by having students measure the classroom.
2. A hand-out on the ventilation formulas will be given to the students.
3. A practice sheet with sample problems will be given to the students.

VENTILATION

Preparing for Field Trip (Mine Ventilation)

OBJECTIVE:

1. The student will review information pertaining to mine ventilation.

2. The student will check over equipment he/she must have to enter the mine.

RESOURCES:

1. Eastover Mining Company - Highsplint, Kentucky.

PRESENTATION AND ACTIVITIES:

1. The instructor will review mine ventilation before, after field trip, and during the tour of the mine.
   a) Ventilating systems - types of fans
   b) Ventilation control devices
   c) Dust control - rock dusting
   d) Instruments used in measuring air current pressure

2. Assign boots, belts, lanterns, caps.

3. Review of self-rescurer and flame safety lamp.

4. Instructor will ask students to be aware of various personnel working in the mines and what their job responsibilities are:
   a) What qualifications are necessary to enter and advance in your occupation?
   b) What is the starting wage?
   c) What are the working conditions - health, safety, hours, security, sick leave, retirement, incentive plan, and vacation?
   d) Do you have to belong to an organization to work here? Is it a union? If so, which one?
   e) How personally satisfying is your job?
   f) What are the main assets?
   g) What are the objectionable features?
   h) What is the outlook for the future for the coal industry?

VENTILATION

Field trip - Eastover Mining Company
Highsplint, Kentucky

VENTILATION

Review of Field Trip

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GLOSSARY OF TERMS (Ventilation and Dust Control)

Aneometer. A small disk fan used to measure the velocity of air.

Approved. Any device, apparatus, equipment, machinery or practice approved by the state commissioner of the Department of Mines and Minerals.

Bleeder entries. Special air courses developed and maintained as part of the mine ventilation system and designed to continuously move air-methane mixtures from the gob, away from the active workings and deliver such mixtures to the mine return air courses.

Bleeder systems. A combination of bleeder entries, bleeder entry connections to any area from which pillars are wholly or partially extracted and all associated ventilation control devices.

Check curtains. Dividers made of nonflammable cloth used in rooms and entries to conduct the air from the last crosscut to the working face.

Coal dust. Fine particles of coal.

Doors. Devices used to direct the air current from its course in one entry so that it will move in another direction.

Entries. Sections with interconnecting corridors.

Float coal dust. Fine particles of coal suspended in the air.

Fundamental formulas in mine ventilation.

$Q=av$	Quantity of air = the area of airways x the velocity.
$p=5.2i$	Pressure per square foot=5.2 lb per sq ft x water gage reading.
$P=pa$	Total pressure=pressure per sq ft x area of mine airway.
$S=lo$	Rubbing surface=length of airway x perimeter of airway.
$R=klov^2$	Resistance=coeffiecient of friction x the length of the airway x perimeter of the airway x the velocity squared.
$P=R$	Total pressure=mine resistance.
$Hp=\frac{pv}{33,000}$	The horsepower=total pressure x the velocity ÷ 33,000.

In Which:

Q = Quantity of air (cfm)
A = Area (sq. ft.)
v = Velocity (f p m)
P = Total pressure (lb)
p = Pressure (sq. ft.)
i = Water gage reading (inches)
R = Resistance
l = Length (ft.)

o = Perimeter (ft.)
S = Rubbing surface (sq. ft.)
k = Coefficient of friction (normally 0.00000002 for coal mines).
Hp = Horsepower

Gob area. One or more rows of unmined pillars around the perimeter of an area where interior pillars have been mined.

Haulageway. The gangway, entry, or tunnel through which coal is hauled.

Line brattice (curtain). Dividers made of nonflammable cloth used in rooms and entries to conduct the air from the last crosscut to the working face.

Mine resistance. Friction created by air rubbing along the top, sides and bottom of the mine.

Overcasts. An airtight bridge which permits the crossing of intake and return airways without interference; in other words, where an air current is crossed over another.

Passageway. An underground tunnel or roadway.

Permissable. Any equipment, device, or explosive that has been approved as permissable by the United States Bureau of Mines or the Mining Enforcement and Safety Administration and meets all requirements, restrictions, exceptions, limitations, and conditions attached by the bureau.

Power upon the air. The horsepower or pressure applied against the mine resistance.

Pure intake air. Any air that has not passed through the last working place of the split or by unsealed entrancies to abandoned workings and by analysis contains not less than mineteen and one-half percent (19½%) oxygen, nor more than one-half of one percent (.5%) of carbon dioxide, nor any dangerous quantities of flammable gas nor any harmful amounts of poisonous gas or dust.

Regulators. An adjustable partial obstruction constructed in an airway to control the distribution of air.

Return air. Air that has passed through the last working place on each split, or air that has passed through abondoned, inaccessible or pillared workings.

Split. When air current is divided into two or more branches, it is said to be split, or each separate current of air is known as a split.

Spontaneous combustion. The process of catching fire as a result of heat generated by internal chemical action.

Stoppings. Concrete blocks, brick, tile or other strong noncombustible material used to keep air currents separated and to force the air ahead, and also used to seal areas already mined - Partitions.

Tail piece. The end of a belt at which coal is generally located; the end of a belt that is nearest the coal face.

Trickle duster. A machine that constantly introduces small amounts of rock dust into the return air current to dilute and render harmless the fine coal dust generated by mining.

Velocity. The speed the air flows through the mine.

Ventilating current. The body of air that is being moved through the mine.

Ventilation. The method of producing, conducting, and distributing a constant current of fresh air through mine workings and returning the impure air to the outside atmosphere.

Water gate. An instrument used to determine differences in air pressure.

FIRES, EXPLOSIONS, AND OTHER EMERGENCIES

- I. INTRODUCTION

- II. MINE FIRES
  - A. Costs That Industry Bears As Result Of Fires
  - B. Fire Triangle
    - 1. Essential Elements
  - C. Sources of Ignition
    - 1. Open Flames
    - 2. Electricity
    - 3. Spontaneous Combustion
  - D. Prevention
    - 1. Fire-Resistant Structures
    - 2. Proper Electrical Installations
  - E. Combating Fires
    - 1. Laws and Procedure In The Use Of These Materials
      - a. Use of rock dust
        - 1. Legal requirement
        - 2. Proper use of dust in fighting a fire
      - b. Chemical extinguishers
        - 1. The classes of fires
        - 2. The need for speed and training in fighting fire
      - c. Water
      - d. Foam
      - e. Portable chemical car
      - f. Fire hose
      - g. Waterlines
  - F. Sealing A Mine
    - 1. Steps
    - 2. Materials
  - G. Unsealing a Fire Area
    - 1. Steps

- III. MINE EXPLOSIONS
  - A. Causes Of Explosions
    - 1. Methane
      - a. Explosive range of methane
      - b. Reasons and prevention of methane explosions
    - 2. Coal dust explosions
      - a. Conditions that cause a dust explosion
      - b. Eliminating the occurance of coal dust explosions

- IV. OTHER EMERGENCIES
  - A. Gas
  - B. Loss of Ventilation
  - C. Inundation

V. COMMICATIONS DURING AN EMERGENCY
  A. Steps To Follow

VI. ESCAPEWAYS
  A. Legal Requirements
  B. Primary and Secondary Escapeways
  C. Practice Drills and Training

VII. EVACUATIONS
  A. Steps To Take For Evacuation

VIII. EMERGENCY ASSEMBLY AND TRANSPORTATION PROCEDURES

IX. BARRICADING
  A. What To Do If You Are Trapped
  B. Definition and Description Of Barricading
  C. Steps and Procedure In Erecting A Barricade
  D. Barricading Materials

X. RECOVERY OPERATIONS AFTER A MINE EXPLOSION
  A. Mine Rescue System
    1. Signals and signalling
    2. Rescue drills and drilling
  B. Steps In Rescue and Recovery Operations
    1. Organization and duties of outside mine personnel
    2. Duties and procedure of underground recovery work
    3. Materials needed for recovery work

FIRES, EXPLOSIONS, AND OTHER EMERGENCIES

Mine Fires

OBJECTIVES:

1. The student will understand the great costs the mining industry must pay due to loss caused by fires; the greatest loss being, loss of human life.
2. The student will explain the term "fire triange:.
3. The student will describe three sources of ignition.
4. After viewing a film, the student will describe causes of mine fires and explosions and tell how they might have been prevented.
5. The student will become familiar with federal and state laws in the use of the following materials:

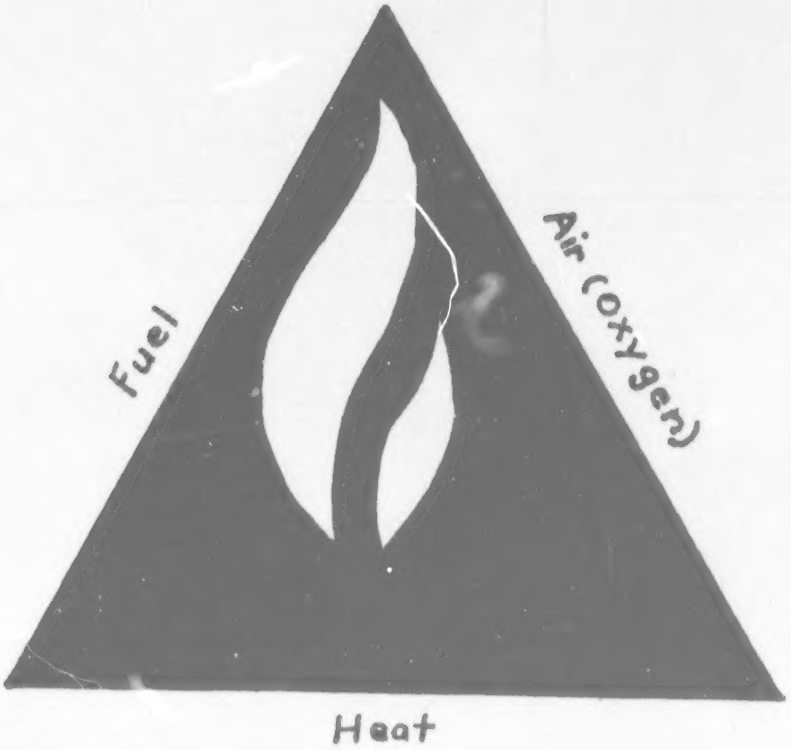
   a) rock dust b) chemical extinguishers c) water
   d) foam e) portable chemical car

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 227-237.
2. MSHA Films "The Magic of Fire" and "Fighting Coal Mine Fires".

PRESENTATION AND ACTIVITIES:

1. Lecture and demonstration - parts of a fire extinguisher and how it is used.
2. Samples of rock dust.
3. View films - discussion.
4. Assigned readings.


Fuel
Air (oxygen)
Heat

Fuel, oxygen, and heat must be present at the same time for fire to occur.

FIRES, EXPLOSIONS, AND OTHER EMERGENCIES

Sealing-Unsealing A Fire Area

OBJECTIVE:

1. The student will determine the proper procedure to follow to protect life and property when direct methods of overcoming a fire are not practical.
2. The student will describe two methods of recovering a sealed fire area.

   a) air locks b) direct ventilation

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 228-243.
2. Coal Mining Reference Book - Pages 83-88.

PRESENTATION AND ACTIVITIES:

1. Assigned readings.
2. Question and answer type discussion.
3. Chalkboard diagrams.

FIRES, EXPLOSIONS, AND OTHER EMERGENCIES

Mine Explosions-Other Emergencies

OBJECTIVES:

1. The student will analyze the causes of two of the most common types of explosions and tell how they could be prevented or minimized.

   a) methane b) coal dust

2. The student will explain how loss of ventilation and inundation creates an emergency and the procedure to follow if each should occur.

3. Given right and wrong communication procedures during an emergency, the student will choose the correct communication procedure.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 244-248.

PRESENTATION AND ACTIVITIES:

1. The instructor will demonstrate how an explosion could occur. A kit from MSHA, if available for loan, will be borrowed. If not, the instructor plans to build his own device.

2. Readings and discussion.

FIRES, EXPLOSIONS, AND OTHER EMERGENCIES

Escapeways-Evacuation

OBJECTIVES:

1. Given a map of a mine, the student will identify the primary and secondary routes of escape from the mine.

2. The student will become familiar with federal regulations concerning escapeways.

3. The student will determine primary escapeway as being in intake air and secondary escapeway as being one in return air.

4. The student will identify precautions the law requires, other than escapeways and maps, in evacuation procedures.

5. The student will list in proper sequence, the steps to take in an emergency evacuation.

RESOURCES:

1. MSHA - Circular "Mine Map Escapeways, Emergency Evacuation, and Barricading" - Pages 4-7.

2. MSHA Safety Manual Number 13, "Fire Safety" Page 31.

3. Code of Federal Regulations - July, 1978, Revised Edition, 75.1704, 75.1704-2.

PRESENTATION AND ACTIVITIES:

1. After discussion of primary and secondary escapeways, the student will be given a blank map and be asked to map the escapeways.

2. Each student will be given Safety Manual Number 13, "Fire Safety" which will be referred to throughout this unit.

FIRES, EXPLOSIONS, AND OTHER EMERGENCIES

Emergency Assembly and Transportation Procedures

OBJECTIVE:

1. After classroom discussion, the student will be able to list ten procedures a miner must receive in training in order to prepare him/her for emergency evacuation.

RESOURCES:

1. MSHA - Circular "Mine Map Escapeways, Emergency Evacuation, and Barricading" - Page 13.

PRESENTATION AND ACTIVITIES:

1. Lecture. The instructor, a certified and qualified mine foreman, will discuss ten procedures the miner must be aware of in emergency evacuation.

FIRES, EXPLOSIONS, AND OTHER EMERGENCIES

Barricading

OBJECTIVE:

1. The student will be able to define "barricade."
2. The student will be able to distinquish between a temporary and permanent barricade.
3. After viewing a film the student will describe when and how to construct a barricade.

RESOURCES:

1. MSHA Film "Plan for Survival".
2. MSHA Safety Manual No. 13 "Fire Safety".
3. MSHA "Mine Map Escapeways, Emergency Evaucation, and Barricading" Pages 13-17.
4. Text - Elements of Practical Coal Mining - Pages 255-258.

PRESENTATION AND ACTIVITIES:

1. View film.
2. Classroom discussion.
3. Assigned readings.

FIRES, EXPLOSIONS, AND OTHER EMERGENCIES

Recovery Operations After A Mine Explosion

OBJECTIVES:

1. After viewing a transparency presentation on mine rescue, the student will describe the steps in rescue and recovery operations, which will include duties and responsibilities of inside and outside mine personnel.
2. The student will review the operation and purpose of the methanometer, flame safety lamp, and the self-rescuer.
3. The student will prepare for field trip to a mine rescue meet.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 248-255.
2. Coal Mining Reference Book - Pages 89-92.
3. Transparencies - "Principles of Mine Rescue".
4. MSHA Instruction Guide - Principles of Mine Rescue.

PRESENTATION AND ACTIVITIES:

1. Transparencies.
2. Demonstration - flame safety lamp, methanometer, and self-rescuer (Review).
3. Discussion in preparation of field trip.

FIRES, EXPLOSIONS, AND OTHER EMERGENCIES

Field Trip

Mine Rescue Meet-

GLOSSARY OF TERMS (Fires, Explosions, And Other Emergencies)

Barricade. To obstruct passage of persons, vehicles, or flying materials.

Barricading . Enclosing part of a mine to prevent inflow of noxious gases from a mine fire or an explosion.

Borehole. Any deep or long drill-hole, usually 2" in diameter or less. It may be a source of air, supplies, and communications in an emergency.

Borer. A device for making holes. The difference between a borer (used for making tunnels, circular shafts, and the like) and a drill is the size of the hole produced. Borers take the large range of plus 3-4 feet. Because of the size involved, a borer is usually much more complex than a drill.

Drill. A machine utilizing rotation, percussion (hammering), or a combination of both to make holes. If the hole is much over 1-2 feet in diameter, the machine is called a borer.

Fill. Any material that is put back in place of the extracted coal to provide ground support.

Flash point. The minimum temperature at which sufficient vapor is released by a liquid or solid to form a flammable vapor-air mixture at atmospheric pressure.

Inby. In the direction of the working face. Towards the working face from a point.

Intake. The passage through which fresh air is drawn or forced into a mine or to a section of a mine.

Outby. Nearer to the shaft, and hence farther from the working face. Toward the mine entrance. The opposite of inby.

Self rescuer. A small respirator that protects a miner against carbon monoxide.

Shaft. A vertical opening through coal mine strata used for ventilation or drainage and/or for hoisting of men or materials.

Shuttle car. A trackless, single-unit, self-powered haulage device used on short runs to transfer broken material from the loading points to the dumping point.

Stopping. Any wall that is built to deflect or impede the flow of ventilating air.

Timber. A collective term for all underground wooden supports.

Violation. The breaking of any state or federal mining law.

Working face. Any place in a coal mine in which work of extracting the coal from its natural deposit in the earth is performed during the mining cycle.

Working place. The area of a coal mine from the outby side of the last open crosscut to the face.

Working section. From the faces to the point where coal is loaded on belts or rail cars to begin its trip.

BLASTING

Transportation and Storage of Detonators and Explosives
Safety Regulations for Underground Blasting
Breaking of Coal

OBJECTIVES:

1. The student will become familiar with federal regulations regarding the transportation and storage of explosives underground.
2. The student will explain how improper storage conditions affects the effectiveness of explosives.
3. The student will become familiar with safety guidelines for underground blasting.
4. The student will describe the hazards involved if there should be a stray electrical current.
5. The student will handle a galvanometer and describe its use in determining circuit conditions of a single or a number of electric detonators connected in a series.
6. The student will describe methods of breaking coal other than by the use of explosives.

   a) cardox b) airdox c) mechanical breaking devices

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 115-120.
2. Coal Mining Reference Book - Pages 104-108.
3. Code of Federal Regulations, Revised Edition, July 1978, Subpart N, 75.1300-75.1308.

PRESENTATION AND ACTIVITIES:

1. Readings.
2. Classroom discussion.
3. Demonstration with galvanometer.

GLOSSARY OF TERMS (Blasting)

Airdox. A device used for breaking coal, whereby air under great pressure is discharged into a borehole in the coal by opening a valve in the copper tubing that conducts the compressed air to the working face and closing the valve after a predetermined pressure has been obtained in the airdox shell.

ANFO. Ammonium nitrate mixed with fuel oil to form a very efficient explosive.

Borehole. A hole drilled in the coal in which explosives are put to blast the coal.

Cardox. A blasting device made of liquid carbon dioxide, confined in a steel shell, and turned into gas by the ignition of a heater element immersed in the liquid within the shell.

Conveyance. Method of transporting.

Deflagration. Rapid burning or combustion.

Detonator. A fuse, percussion cap, for setting off explosives.

Explosive. A subtance (usually a mixture) that where flame or shock is applied, yields readily to rapid combustion or oxidation, accompanied by the formation of such relatively large quantities of gases as to produce much violence and pressure which, in turn, react against their surroundings and cause what is termed an explosion.

Leg wires. A pair of insulated wires attached to the electrical ignition element of a blasting cap.

Magazine. A section box of substantial construction with no metal exposed on the inside, to store explosives or detonators.

ROOF AND RIB CONTROL

I. INTRODUCTION

II. GENERAL CLASSIFICATION OF ROOF
- A. Immediate Roof
  - 1. Types of rock
  - 2. Description
- B. Main Roof
  - 1. Types of Rock
  - 2. Description

III. FLOOR AND RIBS
- A. Ribs
  - 1. Testing and Inspection
- B. Floor
  - 1. Types of Rock
  - 2. Problem Associated With Bad Floor

IV. ROOF IRREGULARITIES
- A. Common Terms
  - 1. Horseback or "Kettle Bottom"
  - 2. "Fault" or Slip
  - 3. Dike
  - 4. Rolls
- B. Roof Testing
  - 1. Experience and Judgement
    - a. Observation
    - b. Sound and Vibrations Method
      - 1. Purpose
      - 2. Students Developing a Proficiency of this Method

V. ROOF SUPPORT, PLANS, AND METHODS
- A. Introduction of Roof Support
  - 1. History
  - 2. Description
  - 3. Systematic Development of Roof Support
  - 4. Hazards
- B. Types of Roof Support
  - 1. Roof Bolting
    - a. Suspension Method
      - 1. Parts and Description
    - b. Laminating Strata Method
      - 1. Description and Use
  - 2. Full Roof Bolting Plan
    - a. Roof Control Plan and Description
    - b. Advantages
    - c. MSHA Laws Governing:
      - 1. Temporary Support
      - 2. Procedure
      - 3. Spacing

3. Conventional Roof Support Plan
    a. Parts and Description
    b. Advantages
    c. MSHA Laws Governing:
        1. Procedure
        2. Spacing
4. Combination Roof Control Plan
    a. Description
    b. Advantages
    c. MSHA Laws:
        1. Procedure
        2. Spacing
5. Special Roof Control Plans and Methods
    a. Pillar Recovery (Second Mining)
        1. Roof Control Plan and Description
        2. MSHA Laws:
            a. Temporary Supports
            b. Procedure
    b. Longwall Mining
        1. Description
        2. MSHA Laws
    c. Roof Support Recovery
        1. Description
        2. MSHA Laws
    d. Problems of Roof and Ribs Control In Other Mining Methods
        1. Room-and-Pillar System
            a. Advantage
            b. Problems That Can Occur
        2. Panel System
            a. Advantage
            b. Problems That Can Occur

ROOF CONTROL
Floor and Ribs - Roof Irregularities

OBJECTIVES:

1. The student will be able to classify various kinds of roofs by the type of rock that forms the immediate roof.

   Shale, Slate, Sandstone, Bone, Limestone, Soapstone, Fireclay

2. The student will be able to state the irregularities often found in the roof and floor of a coal mine.

   Slips, Rolls, Clay, Veins, Horsebacks, Kettlebottoms, Dikes, Cleavages, Faults, Wants

3. Given instruction in the sound and vibration method of testing the roof, the student will simulate the testing procedure in the classroom.

   Tips of fingers resting on roof - gloveless.
   Strike hammer or special testing rod on roof.
   Loose roof will give dull or hollow sound.
   Sound roof will give a solid ring.

RESOURCES:

1. Slides and Tape - Kentucky Mine Safety Training Program
   "Recognition of Hazardous Roof and Rib Conditions" 6-4
   "Sounding Roof and Ribs" 6-5
   "Sound and Vibration Method of Testing Roof and Ribs" 6-6
   "Using a Slate Bar" 6-7
   "When to Inspect Roof and Ribs" 6-8

2. Text - Elements of Practical Coal Mining - Pages 76-77

3. Coal Mining Reference Book - Page 131

PRESENTATION AND ACTIVITIES:

1. Examples of Various Types of Rock. Display.
2. Discussion of Terms. Chalkboard Illustrations.
3. View Slides.
4. Discussion of Slides and Tapes.

*5. Simulation of Sound and Vibration Testing.

6. Assigned Readings.

ROOF CONTROL
Roof Support

OBJECTIVES:

1. After selected readings and class discussion, the student will be able to state the history and systematic development of roof support.

   Timbering, Rock Bolting

2. After viewing a film and slide cassette on roof supports, the student will be able to name and describe two methods of roof support in use in mines today.

   Roof Bolting, Laminating

RESOURCES:

1. Film - MSHA "Make the Roof Safe"
2. Slides and Tape - Kentucky Mine Safety Training Program
   "Guidelines to Prevent Falls of Roof and Rib" 6-9
   "Roof Supports" 6-2
3. "Proper Installation of Supports" 6-3
4. Text - Elements of Practical Coal Mining - Pages 79-96
5. Transparencies - MSHA "Job Safety Guide Roof Bolting Operations"
6. Coal Mining Reference Book - Pages 122-131

PRESENTATION AND ACTIVITIES:

1. Charts and Diagrams
2. Chalkboard Illustrations
3. Classroom Discussion
4. View Film - Discussion
5. View Slides - Discussion
6. Selected Readings
7. Transparencies

ROOF CONTROL
Roof Support Plans

OBJECTIVES:

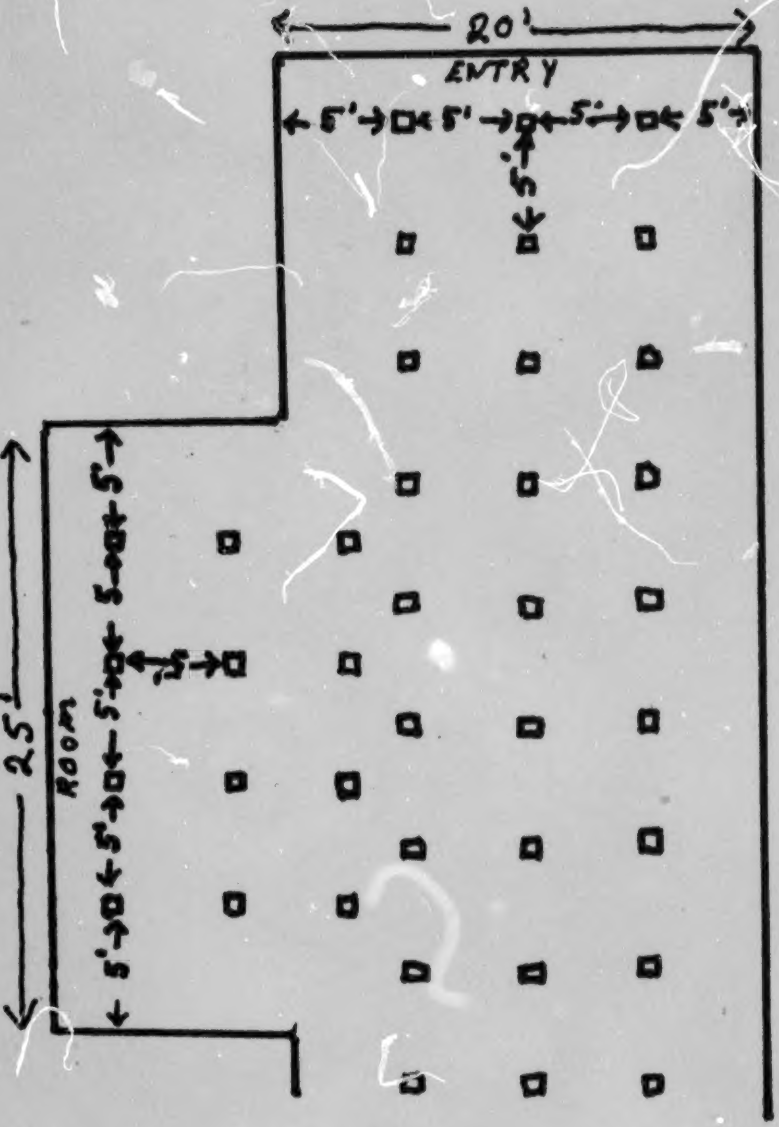
1. Given examples of Three types of roof bolting plans, the student will be able to identify full roof bolting plan, conventional roof support plan, and combination roof support plan.
2. After selected readings and classroom discussion, the student will be able to state specific laws that govern control of the roof.
3. After reviewing various roof bolting plans, the student will draw a map depicting roof control of imaginary mine.

RESOURCES:

1. Text: Elements of Practical Coal Mining - Pages 96-104
2. Code of Federal Regulations, July 1, 1978 Revised Edition, Subpart C, 75.205 Pages 428-436

PRESENTATION AND ACTIVITIES:

1. Examples of Roof Support Plans
2. Students Will Draw a Roof Control Plan
3. Readings and Discussion of Laws Governing Roof Support
4. Lecture


20'
ENTRY
5'
5'
5'
5'
5'
25'
ROOM
5'
5'
5'
5'
5'
5'
5'

Typical example of roof bolting pattern in entry and room. Bolting is on 5-foot centers except where room was started. These bolts were installed before the first cut in the room was made. Some roofs may require bolts on a closer pattern due to natural weakness.

ROOF CONTROL
General Classification of Roof

OBJECTIVES:

1. The student will be able to define terms that relate to roof control.

   Ribs, Slip, Rolls, Fault, Timbers, Crib, Roof Bolting, Headers, Immediate Roof, Main Roof

2. The student will be able to describe and give characteristics of two types of roof.

   Immediate Roof, Main Roof

3. The student will be able to identify and describe potentially hazardous roof conditions.

4. The student will be able to state facts and figures which show that the number one cause of fatal accidents in the mines is due to the fall of the roof and unsafe action by the miner..

   1966 - 1977 -

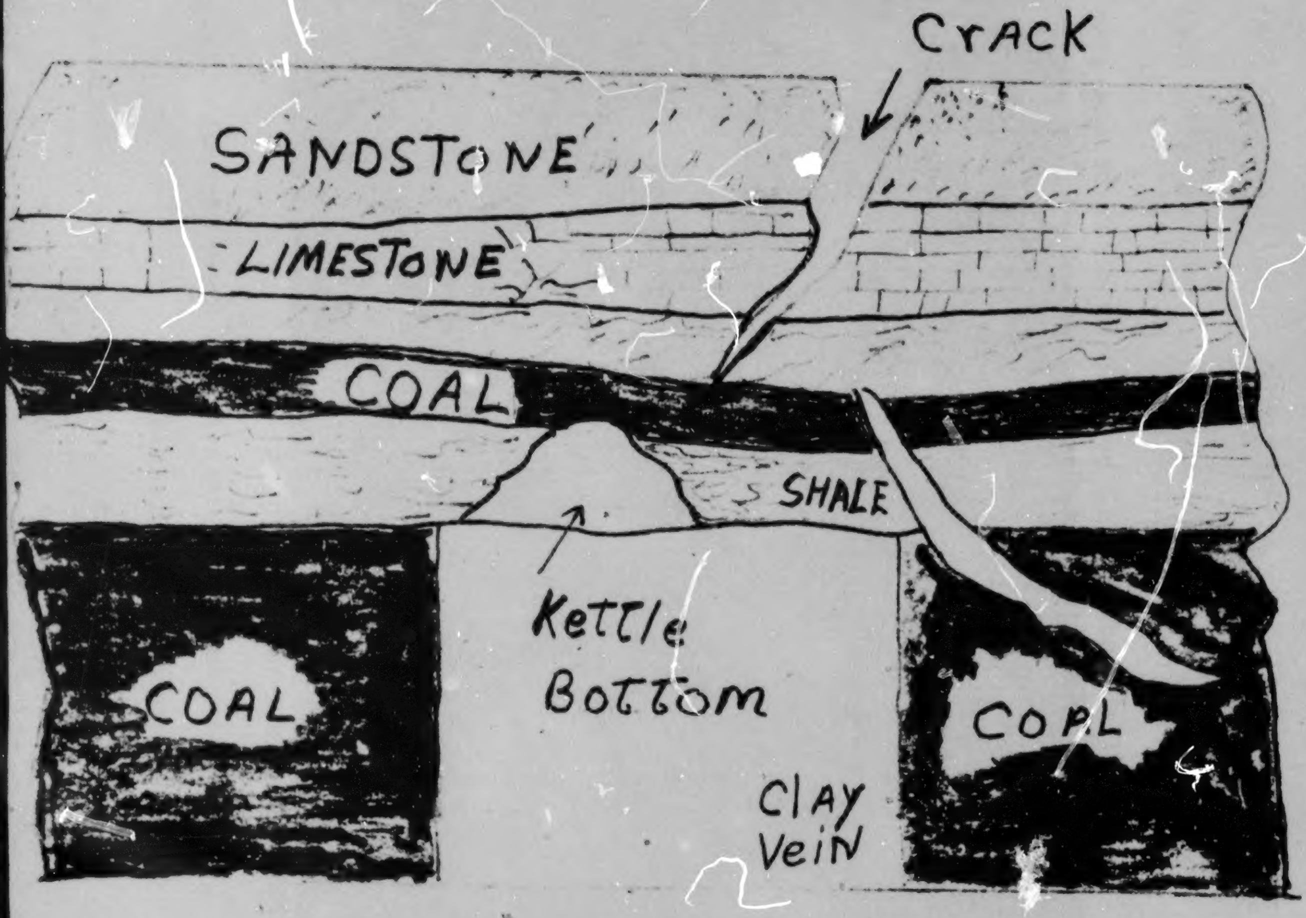
   1.) Failure to follow roof support plan
   2.) Failure to observe roof condition

RESOURCES:

1. Films - MSHA "Rock Botling Safety"
   "Who is Right or Wrong"
2. Text - Elements of Practical Coal Mining - Pages 72-75
3. Slides and Tape - Kentucky Mine Safety Training Program Introduction to Roof and Rib Control" -6-1
4. Coal Mining Reference Book - Pages 118-120

PRESENTATIONS AND ACTIVITIES:

1. Introduction - Overview of Roof Control - Lecture
2. Terminology - Discussion
3. View Films and Slides - Discussion on Accidents and How They Could Have Been Prevented
4. Post Film Discussion
5. Assigned Readings
6. Fact Sheet On Roof Accidents and Fatalities



Crack
SANDSTONE
LIMESTONE
COAL
SHALE
Kettle Bottom
COAL
COAL
Clay Vein

VISUAL INSPECTIONS

INSPECT THE ROOF AND RIBS FOR:

(1) STRESS CRACKS IN ROOF, FLOOR, AND RIB;

(2) KETTLEBOTTOMS, CLAY VEINS; OR ANY ABNORMAL ROCK FORMATION;

(3) A FORMERLY DRY PLACE THAT BECOMES WET;

(4) SMALL CHIPS OR BARK AROUND TIMBERS.

(5) MOISTURE OR CRACKS THAT MAY APPEAR IN THE ROOF LONG AFTER THE AREA HAS BEEN SUPPORTED;

INSPECT SUPPORTS FOR:

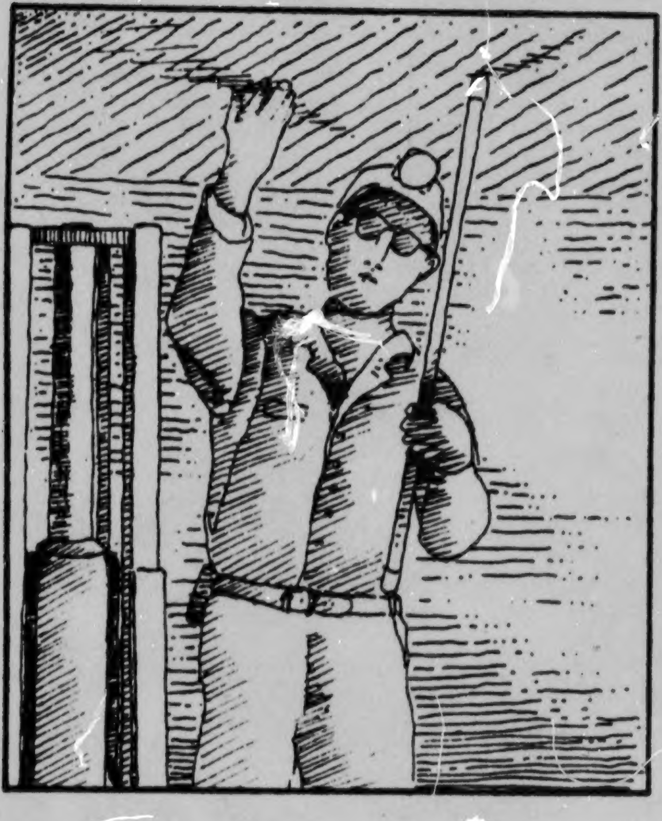
(1) CROSSBARS, TIMBERS, AND POSTS THAT ARE BENT OR HEAVY PRESSURE;

(2) ROOF BOLTS THAT SHOW SIGNS OF STRESS;

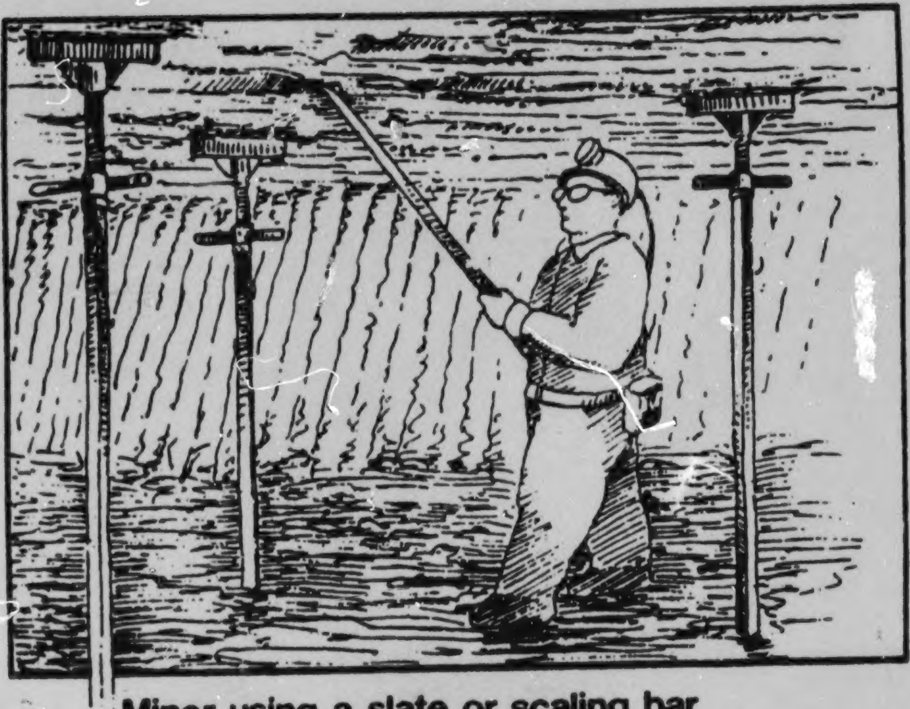
(3) CAP PIECES SQUEEZED DOWN AND OVER POSTS;

(4) TIMBERS DECAYED THROUGH TIME.

ROOF TESTING



SCALING

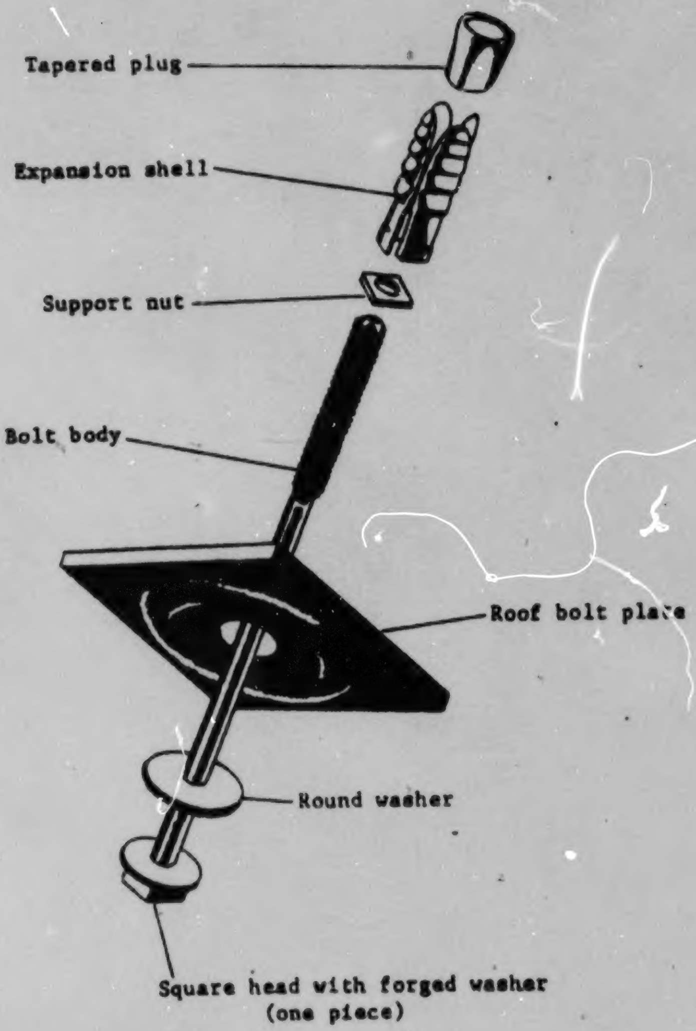


Miner using a slate or scaling bar

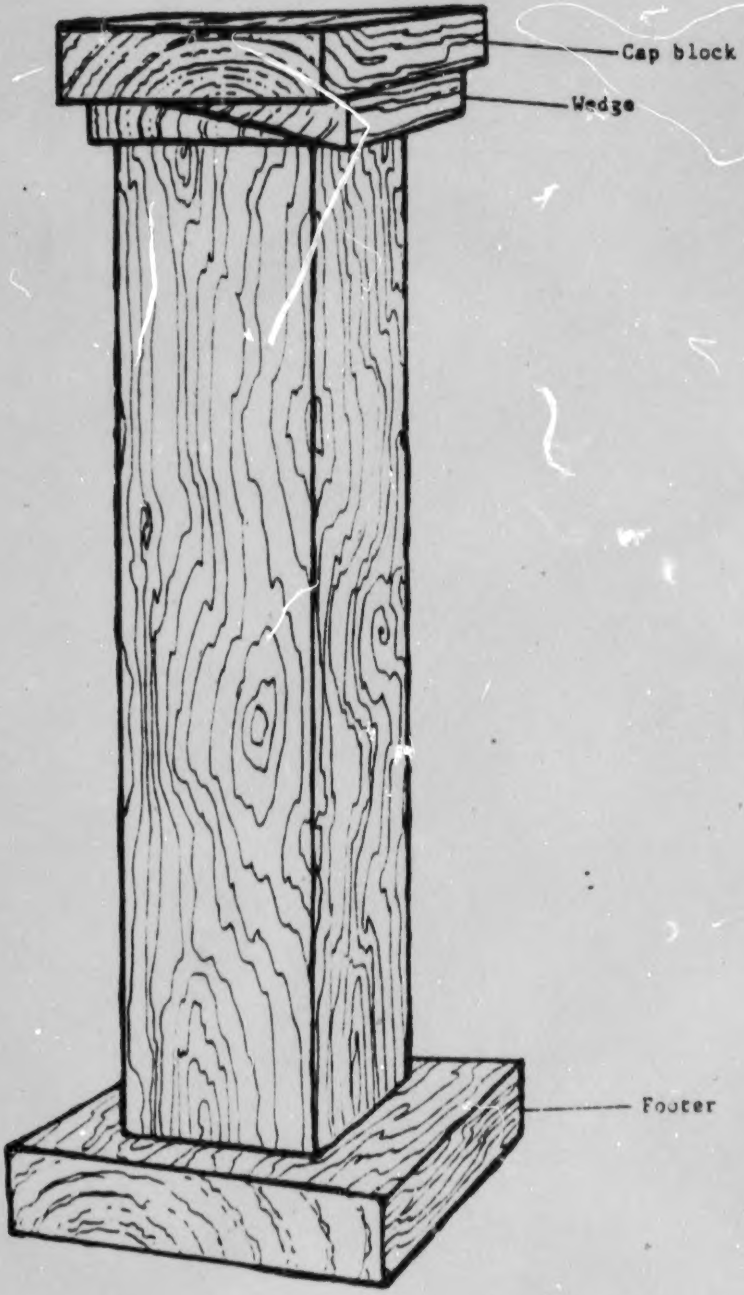
SCALING RULES

1. WEAR GOGGLES.
2. BAR AT AN ANGLE.
3. PRY UP.
4. BE UNDER A SUPPORTED ROOF.
5. BALANCE YOUR BODY.
6. ENSURE THE BOTTOM IS CLEAR BEHIND YOU FOR A SAFE RETREAT.

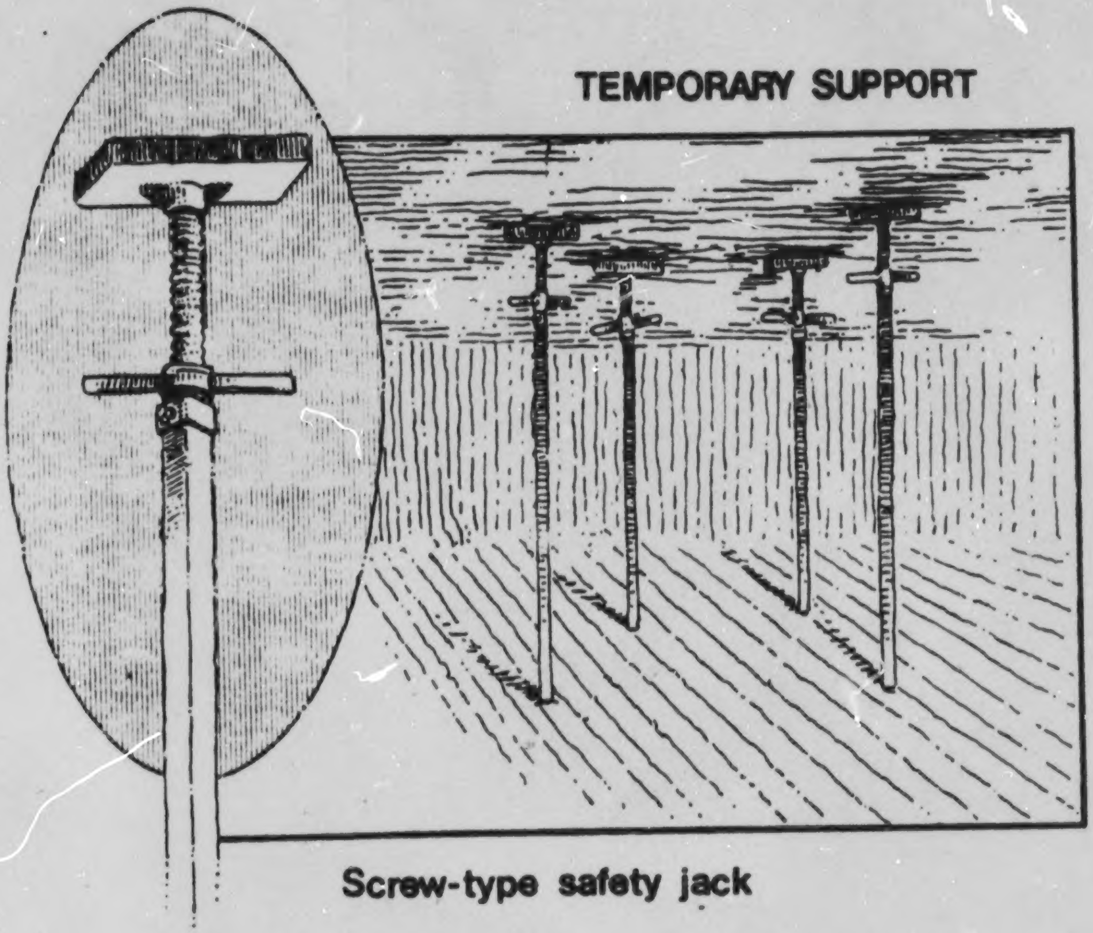
ROOF BOLT


Tapered plug
Expansion shell
Support nut
Bolt body
Roof bolt plate
Round washer
Square head with forged washer
(one piece)

POST INSTALLATION

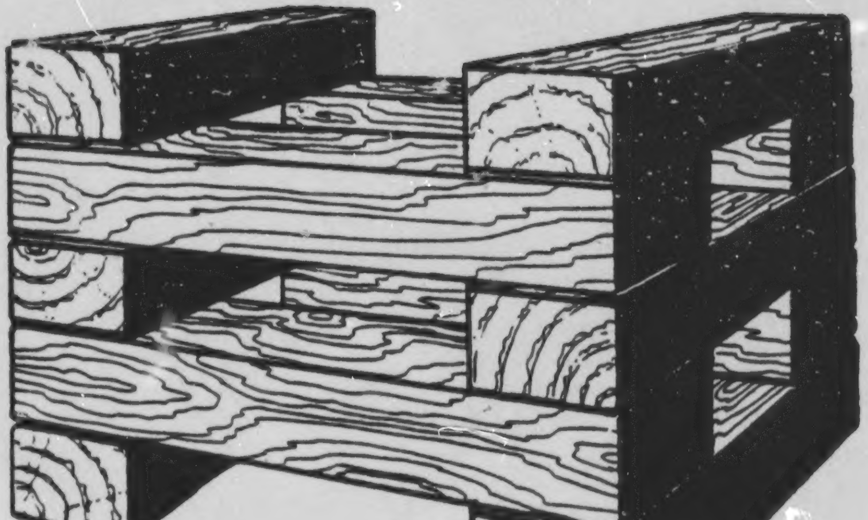

Cap block
Wedge
Footer

TEMPORARY SUPPORT



Screw-type safety jack

CRIB



ROOF CONTROL

Special Roof Support Plan

OBJECTIVES:

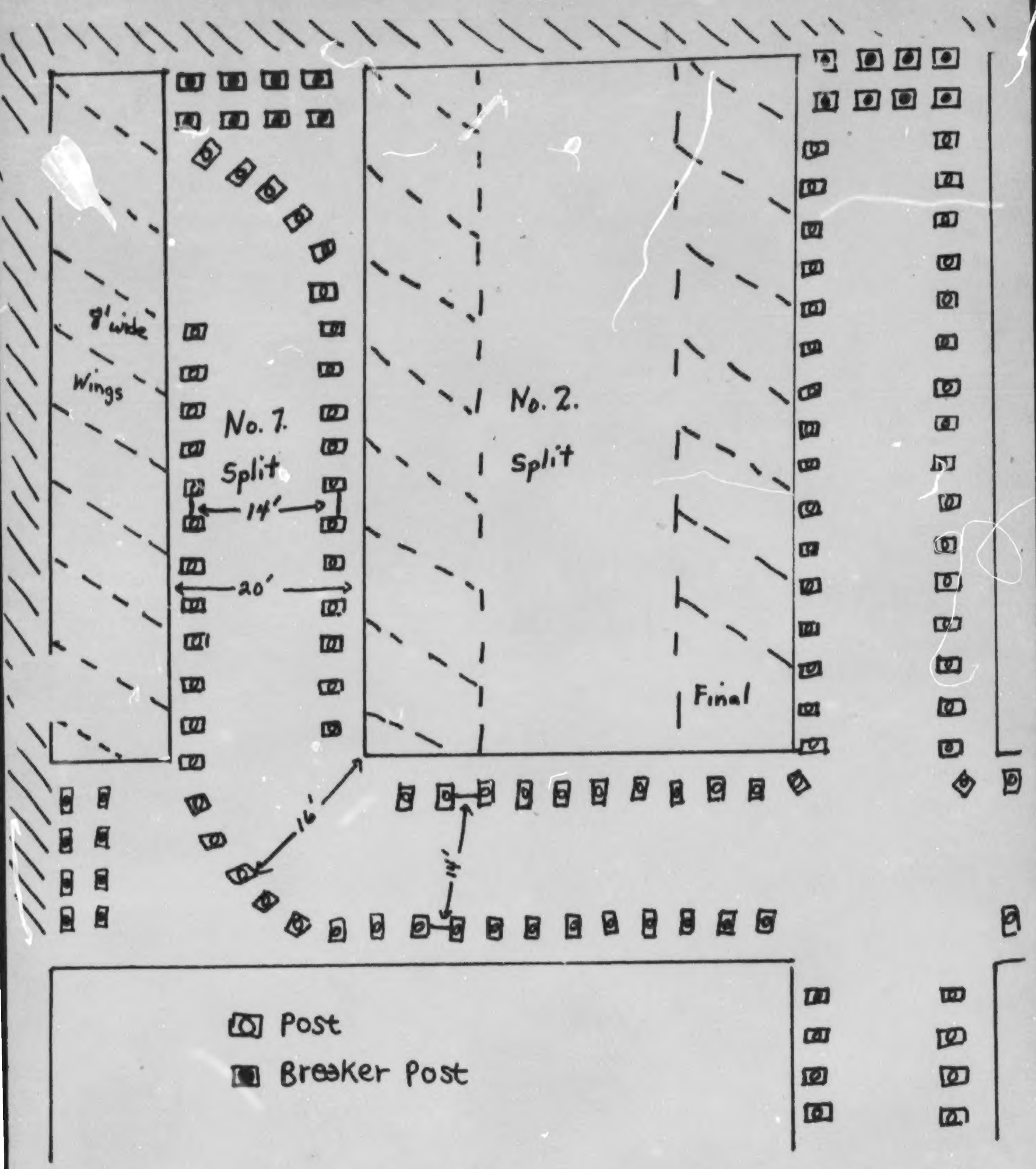
1. Given the terms, "second mining" and "pillar recovery", the student will define the meaning of each and state the procedure used in each type of mining.
2. The student will be able to state the difference between "longwall" mining and "room-and-pillar" mining.
3. The student will be able to state the laws governing longwall mining.

RESOURCES:

1. Text - Elements of practical Coal Mining - Pages 93-96
2. Code of Federal Regulations, July 1, 1978, Revised Edition, Subpost C 75.201-1,2, and 3.

PRESENTATION AND ACTIVITIES:

1. Lecture
2. Selected Readings
3. Charts and Diagrams
4. Discussion


8' wide
Wings
No. 1.
Split
14'
20'
No. 2.
Split
Final
16'
14'
Post
Breaker Post

Roof support plan for full pillar extraction. Where bolting is required only one row of posts is used, limiting roadway width to 16 ft. The 8-ft. wide wing split can be mined without exposure of men so are not supported.

GLOSSARY OF TERMS (Roof and Rib Control)

Beam. A bar or straight girder used to support a span of roof between two support props or walls.

Bearing plate. A plate used to distribute a given load. In roof bolting, plate used between the bolt head and the roof.

Bolt torgue. The turning force applied to a roof bolt to achieve an installed tension in footpounds.

Bone. Termed bone coal or boney. It is a slatey or argillaceous coal, or carbonaceous shale.

Break line. The line along which the roof of a coal mine is expected to break, roughly following the rear edges of the pillars that are being drawn or mined.

Cap block. A flat piece of wood inserted between the top of the prop and the roof to provide bearing support.

Continuous mining. Mining in which the continuous mining machine cuts or rips coal from the face and loads it onto conveyors or into shuttle cars in a continuous operation. Thus, the drilling and shooting operations are eliminated.

Conventional mining. The cycle of operations which includes cutting the coal, drilling the shot holes, charging and shooting the holes, loading the broken coal and installing roof support.

Crib. A structure composed of frame or timber laid horizonally upon one another, or of timbers built up as in the walls of a log cabin.

Crossbar. The horizonal member of a roof timber set supported by props located either on roadways or at the face.

Cup piece. A short piece of wood placed over the post to give it a firm bearing and provide additional supporting area.

Dike. An intrusion through the coalbed formed by molten rock.

Draw slate. Any shale, fire clay, or soapstone that comes down, or must be taken down, after the supporting coal has been removed, is termed draw slate.

Entry. A coal heading. A working place where the coal is extracted from the seam in the initial mining.

Face. An area in a coal mine where coal is being extracted from its natural deposit in the earth. The face is formed during the mining cycle.

Fault. A fracture in the coal seam accompanied by displacement.

Fire clay. A material or deposit of mud that time and pressure have changed to rock. It is chiefly derived of kaolin and ranges in color from white to deep gray.

Fissure. An extensive crack, break, or fracture in the rocks.

Gob area. Coal and other minerals that are not marketable in the mine. That part of the mine where coal has been extracted and the resulting space, more or less, filled up by fallen material.

Gunite. A mixture of cement and sand, water-blown by air pressure onto the surfaces to be coated, such as roofsand sides.

Headers. Long pieces of wood placed on top of posts to help support the roof. Half-header-half crossbar.

Horseback and kettlebottom. Terms used interchangeably, and refer to a mass formed by a fossilized tree trunk, at the top of the coal seam, that is so poorly joined to the roof material that it may drop out unexpectedly. "Kettlebottom" refers to an extremely hard concretion in the roof shaped like a flattened ball. It may be from a few inches in diameter up to about three feet.

Immediate roof. The roof immediately above the coal bed.

Inby. Toward the working face or interior of the mine, away from the shaft or entrace.

Lamination. Process in roof bolting by which the bolts are used to bind different roof strata together under a certain amount of pressure, much like the manufacture of plywood.

Limestone. A stone formed by shells and bones of organisms that formerly lived in the water. It is mostly composed of calcium carbonate.

Longwall mining. A method of working coal seams believed to have originated in England toward the end of the 17th Century. The seam is removed in one operation by means of a long working face or wall advancing in a continuous line which may be several hundred years long.

Mine roof. The layer of hardened clay, limestone, sandstone, or other material that lies over the coal bed; rock or other material above the coal seam.

Main roof. Roof above the immediate top. It may vary in thickness from a few feet to several thousand feet depending on the depth of the coal.

Overburden. The material of any nature, consolidated or unconsolidated, that overlies a deposit of coal.

Pillar. An area of coal left to support the overlying strata in a mine; sometimes left permanently to support surface works or against old workings containing water.

Pot. A rounded mass of roof slate resembling an iron pot. It is separated from the other slate by old mud cracks and is liable to fall without warning.

Resin bolts. Sometimes called glue bolts, are bolts with packets of resin attached to the end, so when the bolt is driven into the hole, the packet bursts, and the resin spreads out around the bolt and becomes hardened.

Rib. The side or a pillar or the wall of an entry.

Robbing. Second-mining or retreat mining, in which the pillars are mined, or taken out.

Rolls A small downward bending of the roof into the coalbed or a similar upward thrust of the floor. This term is sometimes used to denote a "clay vein" in either the roof or floor that penetrates the coal seam in part or in whole Where rolls reduce the coalbed thickness over such a sizable area as to disrupt normal mining projections, it is called a "want".

Roof bolt. A long steel bolt inserted in a drilled hole used to support mine roof; the unit consists of the bolt, steel bearing plate, and expansion shell.

Roof bolting. Anchoring a weak immediate roof to a strong, firm structure with bolts.

Roof jack. A screw- or pump- type hydraulic extension post made of steel used as temporary roof support.

Roof trusses. A combination of steel rods anchored into the roof to create zones of compression and tension forces and provide better support of weak roof and roof over wide areas.

Room-and-pillar. A system of mining in which the distinguishing feature is the mining of 50 percent or more of the coal or ore in the first working. The coal or ore is mined in rooms separated by narrow ribs or pillars which are left to hold the roof. The rooms are driven parallel with one another, and the room faces may be extended parallel, at right angles, or at an angle.

Sandstone. (Sandrock) A grainy rock composed of sand (silica) cemented together by calcium carbonate or other fine material.

Shale. A rock formed by consolidation of clay, mud, or silt; has a laminated structure; composed of minerals essentially unaltered since deposition.

Skin. The first thin layer above the coal bed.

Slate. Another term for a shale that splits into thin horizonal laminations with straight cleavage planes. It is found in various colors, black, gray, and greenish being the most common.

Slate bar. The proper long handle tool used to pry down loose and hazardous material from roof, face, and ribs.

Slip. A vertical or near vertical plane along which the roof is fractured, and can frequently denote a small displacement fault.

Sloughing. The slow crumbling and falling away of material from roof, rib, and faces

Soapstone. A massive variety of impure talc and is known as steatite. It may be white, gray, or greenish in color.

Spalling. The sloughing, slow crumbling, of material from roof, face, or rib.

Squeeze. The roof settles without breaking and gradual upheaval of mine floor due to weight of mine roof.

Stratum. A sheetlike layer of sedimentary rock.

Suspension. The act of hanging. Weaker strata hanging from stronger overlying strata by means of roof bolts.

Tension. Stretching applied to rock as a result of mining, or to a roof bolt or roof truss as a result of tightening.

Timbering. The setting of timber supports in mine workings or shafts for protection against falls from roof, face, or rib.

Treated timbers. Timber treated with chemicals such as creosote, zinc choride, or by other methods to season and extend useful life.

Wooden posts. Often called "timbers". Posts are set vertically and tightened between floor and roof.

ELECTRICITY

- I. INTRODUCTION
  - A. History
  - B. Electricity Through Cables, Wires, and Transformers, Power Moving Equipment
  - C. Miners Must Know How to Recognize and Avoid Electrical Hazards

- II. BASIC THEORY
  - A. Moving Electrons Are Electricity
  - B. Current Is The Flow Of Electrons
  - C. Voltage Is The Electrical Pressure On A Current
  - D. Conductors Allow Current To Flow
  - E. Resistance Is The Ability Of A Material To Oppose Electron Flow
  - F. Insulatros Do Not Allow Current To Flow
  - G. Electricity Flows Through A Circuit To Power A Machine
  - H. Grounding Prevents Electrical Shock
  - I. Alternating Current (AC)
    - 1. Advantages of underground use
    - 2. Common underground equipment
  - J. Direct Current (DC)
    - 1. Advantages of underground use
    - 2. Common underground equipment

- III. TRANSMITTING AND TRANSFORMING POWER IN A MINE
  - A. Power Centers
    - 1. Transformers
      - a. Reduce voltage to usable levels
      - b. Use high voltage
    - 2. Rectifier
      - a. Change AC to DC
    - 3. Distribute power to various machines
    - 4. Energizing and de-energizing
    - 5. Qualified persons energize and de-energize, or persons trained to energize and de-energize specific machines
    - 6. Tagging out plugs (cat-heads)
  - B. High Voltage Lines
    - 1. Marked by signs
    - 2. Should be avoided
  - C. Low and Medium Voltage Lines
    - 1. Carry large currents
    - 2. Should be avoided
  - D. Trolley Wire and Cables
    - 1. Use uninsulated conductors
    - 2. Should be avoided and properly guarded
  - E. Nips
    - 1. Supply power to machines from trolley or feeder wires
    - 2. Procedure for nipping
      - a. Wear insulated gloves or boots
      - b. Cut switches on the machine to be powered
      - c. Insure that ground and return wires are secure
      - d. Hold nip at arms length and turn head
      - e. Touch back of hook to check for arc
      - f. Hang nip on cable

F. Trailing Cables
   1. Description and use (AC and DC)
   2. Wear insulation when handling cables
   3. Care and maintenance of cables
   4. Use caution standing near or crossing cables

G. Recognizing and Splicing Damaged Cables
   1. Damaged insulation must be repaired
   2. Check for holes, worn spots, smoking cables
   3. To recognize and appreciate the importance of a safe and well insulated cable with the knowledge that only a qualified person can splice a cable the student will learn how to splice an AC cable.

H. Circuit Breakers and Fuses
   1. Prevent overloads
   2. Must be maintained at specific settings

I. Batteries
   1. Contain dangerous voltages
   2. Present hazard of acid burns and explosion

IV. HUMAN BODY AND ELECTRICAL SHOCK

A. The Body as a Part of a Circuit
   1. Path of least resistance
   2. Safety precautions

B. Effects of Electricity on the Human Body
   1. Paralysis
   2. Ventricular fibrillation
   3. Heart stoppage

C. Rescue
   1. Disconnect power
   2. Non-conductors of electricity

D. Electrical Accidents
   1. Arcs
   2. Electrically generated heat
   3. Electrocution
   4. Shock

E. Personnel
   1. Qualified

V. ELECTRICITY IN PREPARATION PLANTS

VI. ELECTRICITY IN SURFACE MINING

VII. PRIME CONSIDERATIONS IN DESIGNING AN ELECTRICAL SYSTEM

VIII. LAWS GOVERNING ELECTRICITY IN UNDERGROUND MINES

A. Kentucky State Laws

B. Federal Laws

ELECTRICITY

Introduction - Basic Theory

OBJECTIVES:

1. The student will gain background information on how and why electricity is used in underground mines.
2. The student will define and use the terms voltage current, resistance, conductor and insulation as they apply to materials and installations in underground mines.
3. The student will differeniate between AC current and DC current and give an example of how each is used in the mine.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 259-264.
2. MSHA - Cicular "Electrical Hazards- Pages 5-6.
3. Coal Mining Reference Book - Page 67.
4. Kentucky Mine Safety Training Program - Sli[illegible] - Cassettes "Basic Concepts of Electricity" - 9-1.

PRESENTATION AND ACTIVITIES:

1. Lecture - a) Draw diagram of a circuit on blackboard, b) Use a lightbulb as an example, c) Use a three-prong plug as an example of ground.
2. View slides - Discuss terminology.
3. Assigned reading.

ELECTRICITY

Transmitting and Transforming Power in a Mine
(Power Centers - High, Low, Medium Voltage)

OBJECTIVES:

1. The student will describe the operation of a power center by defining:
   a) transformer - what is it, what does it do?
   b) rectifier - what is it, what does it do?
   c) tagging-out
   d) energizing, de-energizing
2. The student will identify "high voltage" lines and explain the precautions required to work near them.
3. The student will identify "low voltage" and "medium voltage" lines and actions that should be avoided when working near them.

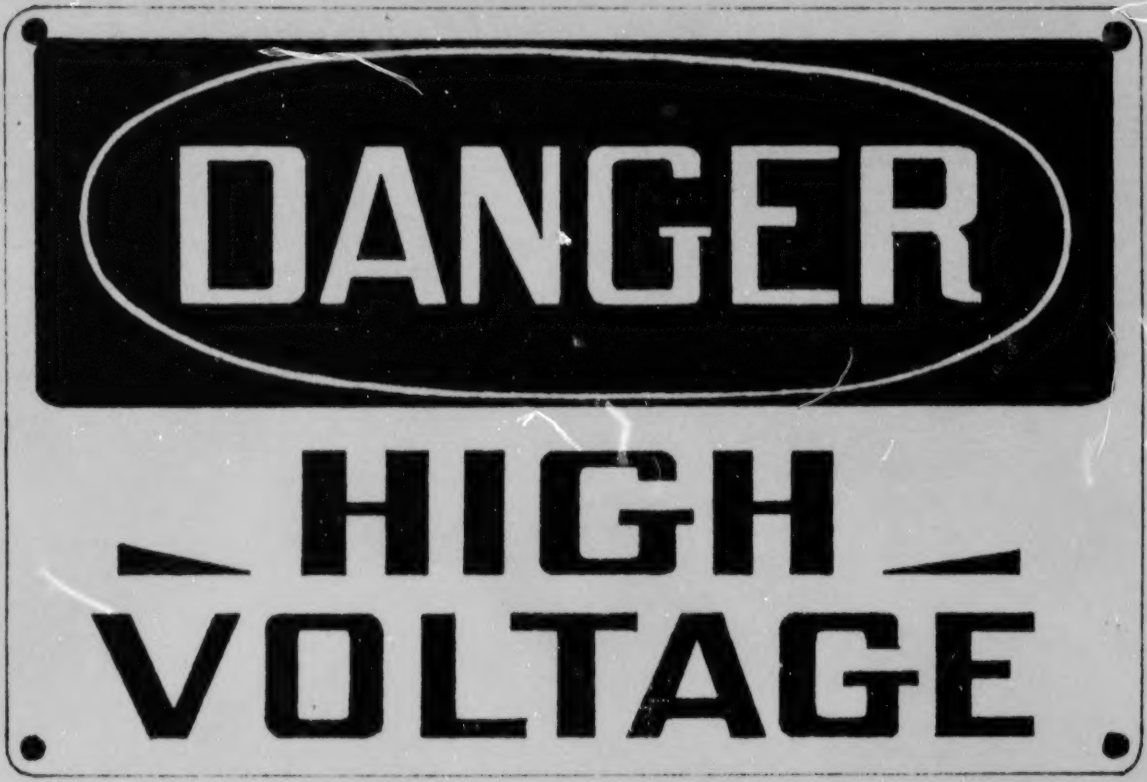
RESOURCES:

1. Kentucky Mine Safety Training Program-Slides and Cassettes
   "Coal Mine Electrical Systems" 9-2
   "Safety Around Power Centers" 9-5
2. MSHA Film "Electrical Hazards in Underground Coal Mining"
3. Code of Federal Regulations - July, 1978 Revised Edition Section 75, 153
4. Text - Elements of Practical Coal Mining - Pages 259-292
5. MSHA - Circular - "Electrical Hazards" Pages 14-16

PRESENTATIONS AND ACTIVITIES:

1. Lecture - Using Charts and Posters
2. View slides
3. View film - discussion
4. Definition and discussion of terms

HIGH VOLTAGE SIGN


DANGER
HIGH
VOLTAGE

Stay away from any equipment marked by this sign.

ELECTRICITY

Transmitting and Transforming Power In A Mine
(Trolley Wires - Nips - Trailing Cables)

OBJECTIVES:

1. By the end of this lesson, the student will know how to carry materials that are conductors and how to work around trolley wires.
2. The student will describe the procedure for "nipping".
3. The student will explain the procedure and hazards of handling energized low and medium trailing cables.

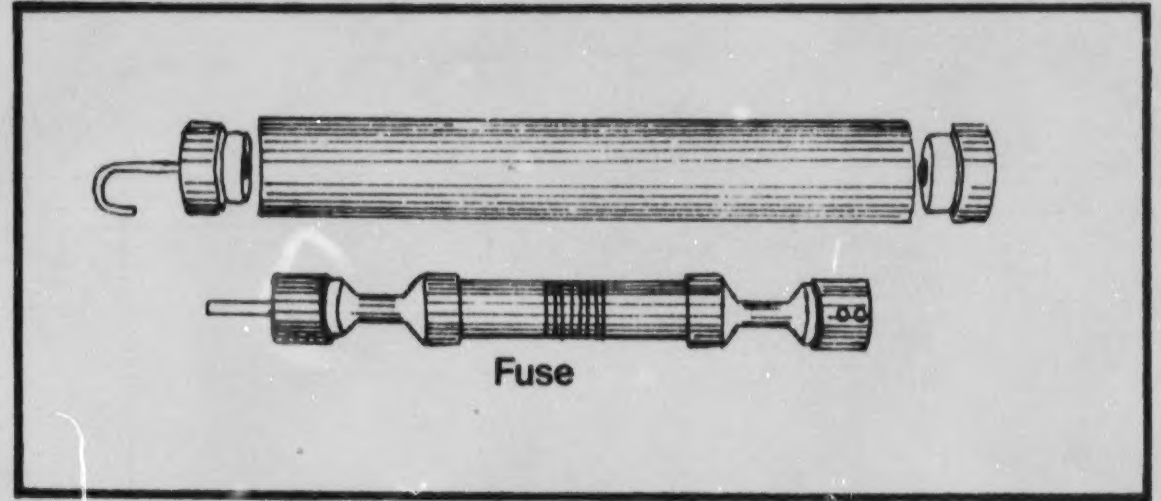
RESOURCES:

1. MSHA Circular "Mine Hazards" - Pages 17-20.
2. Kentucky Mine Safety Training Program - Slides and Cassettes.
   "Conductors and Insulators in the Mine" - 9-4
   " Safety Around Trolley Wires" - 9-4

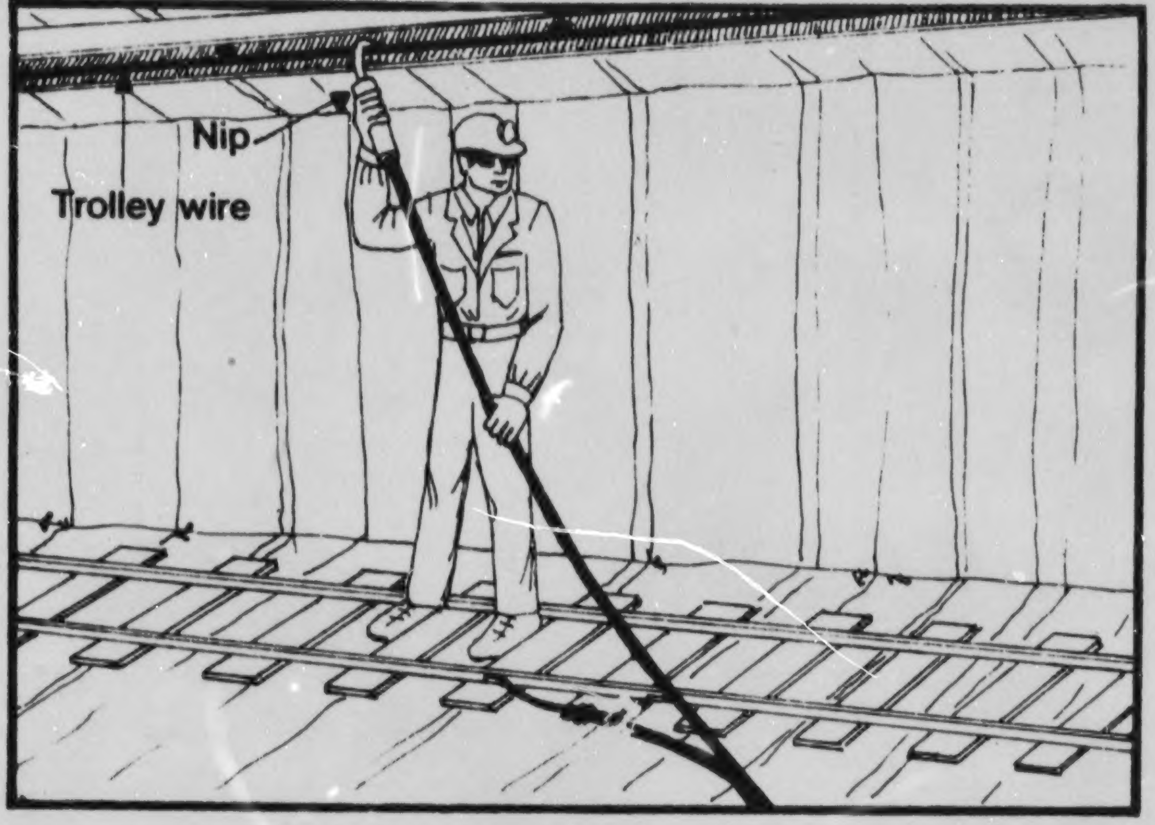
PRESENTATION AND ACTIVITIES:

1. Lecture - Pictures of Nips and Procedures Used for Nipping
2. View Slides - Discussion
3. Demonstration - Good Wires - Damaged Or "Bad" Wires

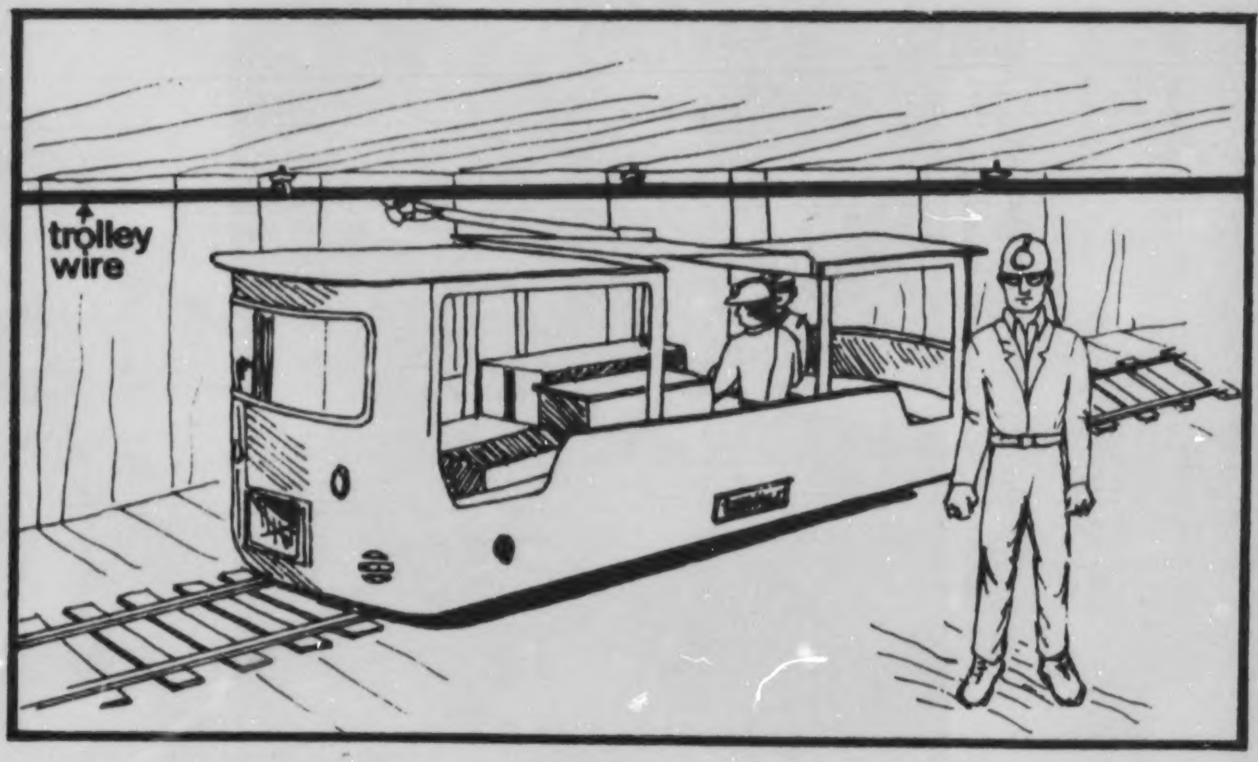
NIP



"NIPPING ON"


Nip
Trolley wire

TROLLEY WIRE


trolley wire

ELECTRICITY

Transmitting and Transforming Power In A Mine
(Splicing Damaged Cables)

OBJECTIVE:

1. The student will be able to recognize a damaged cable by checking for holes, worn spots, and smoking cables.
2. By the end of this lesson, each student will be able to splice an AC cable.
3. The student will be able to identify the person or persons responsible for splicing cables in the mine.

RESOURCES:

1. Kentucky Mine Safety Training Program - Slides and cassettes. "Electrical Cable Safety" - 9-6.
2. Damaged AC cables.

PRESENTATION AND ACTIVITIES:

1. View slides - Discussion.
2. Demonstration - instructor will demonstrate proper method of splicing cable.
3. Each student will splice a cable.

ELECTRICITY

Transmitting and Transforming Power In A Mine
(Circuit Breakers and Fuses, and Batteries)

OBJECTIVES:

1. The student will explain why the setting on a circuit breaker should never be changed.
2. The student will explain the purpose of a fuse.
3. The student will describe the hazards of handling and servicing batteries and battery charging equipment.

RESOURCES:

1. MSHA Circular " Electrical Hazards" - Pages 22-23.
2. MSHA Film - "Electrical Lock-Out Procedures".

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Demonstration - Circuit breaker and fuse.
3. View film - Discussion.

ELECTRICITY

Electricity in Preparation Plants
Electricity in Surface Mining
Prime Considerations in Designing an Electrical System

OBJECTIVES:

1. The student will describe type and function of electrical motors used in preparation plants.
2. The student will be able to determine the difference in electrical equipment used in surface mining operations and that used in underground mining.
3. The student will become aware of the prime consideration given to the designing of an electrical system.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 282-289.

PRESENTATION AND ACTIVITIES:

1. Assigned readings.
2. Classroom discussion.

ELECTRICITY

Laws Governing Electricity In Underground Mines

OBJECTIVE:

1. The student will become familiar with laws relating to electricity in underground mines.

RESOURCES:

1. Code of Federal Regulations - July 1978, Revised Edition, Section 75.153.
2. Laws Governing the Mining of Coal and Clay - 1976 Edition, Section 371.109.

PRESENTATION AND ACTIVITIES:

1. Reading of federal and state laws.
2. Classroom discussion.

ELECTRICITY

The Human Body and Electrical Shock

OBJECTIVES:

1. The student will identify and describe the various effects that electricity could have on the human body.

   a) hand paralysis b) respiratory paralysis
   c) ventricular fibrillation d) heart stoppage

2. The student will trace the effect of electricity on the human body beginning with 1 MA (milliampere) to 200 MA. (1000 milliamperes equals 1 ampere.)

3. The student will describe actions to be taken if a fellow miner comes in contact with an energized wire or cable.

4. The student will be able to state what injuires from arcs, electrical heat, shock, and electrocution all have in common.

5. The student will be able to determine who is responsible for any repair, installation, or testing of electrical equipment.

RESOURCES:

1. Code of Federal Regulations - July 1978 Revied Edition, Section 75.153.

2. MSHA Circular - "Electrical Hazards" - Pages 9-14.

PRESENTATION AND ACTIVITIES:

1. Assigned readings.

2. Classroom discussions.

3. Pictures.

4. Transparencies (Teacher made).

EFFECTS OF CURRENT ON THE BODY

CURRENT	EFFECTS
Safe Currents	
1 MA* or less	CAUSES NO SENSATION - NOT FELT. Is at threshold of perception.
1 MA to 8 MA*	Sensation of shock. Not painful. Individual can let go at will, as muscular control is not lost. (5 MA is accepted as maximum harmless current intensity.)
Unsafe Currents	
8 MA to 15 MA*	Painful shock. Individual can let go at will, as muscular control is not lost.
15 MA to 20 MA*	Painful shock. Muscular control of adjacent muscles is lost. Cannot let go.
20 MA to 50 MA*	Painful. Severe muscular contractions. Breathing is different.
100 MA to 200 MA*	VENTRICULAR FIBRILLATION (condition in which regular heart muscle contractions are replaced by irregular twitches). Death will result if CPR or cardiac arrest procedures are not followed.
200 and over MA*	Severe burns. Severe muscular contractions, so severe that chest muscles clamp heart and stop it during duration of shock.

*1000 milliamperes = 1 ampere

GLOSSARY OF TERMS (Electricity)

Alternating current (AC). The voltage (hence the current) builds from zero to a positive maximum then decreases to zero, goes to a negative maximum, and comes back to zero with each cycle. It alternates, flowing first in one direction, then reversing and flowing in another.

Ampere (amp). The time rate of flow of electrons. It is similar to the numbers of gallons per minute flowing in a hydraulic circuit.

Bonding. The installation of heavy flexible wires across joints of steel rails (which serve as the return circuit) for the purpose of lowering joint resistance.

Conductor. Material which allows electrical current to flow through it with ease. Some common conductors are copper, steel, and aluminum.

Contactors and relays. Contactors are devices that make or break the power circuit feeding a load when its operating coil is energized or de-energized. The contacts handle the heavy current of the power circuit. A relay is very similar in appearance and operation except its contacts handle the control circuit where the current is generally quite low.

Delta-connection. A type of connection used to connect electrical devices in a 3-phase configuration where the neutral point is not available. Here the line voltage equals the phase voltage, and line current equals the phase current (through each winding) multiplied by 1.732.

Direct current (DC). Current flows in one direction constantly.

Distribution voltage. In coal mining this is generally the high voltage transmission system, such as 4,160, 7,200, or 12,470v. It can be outside on poles and crossarms, while inside it will be the high voltage cable system.

Electrical diagrams. There are three types; 1) the one-line diagram is in an electrical-shorthand types. Standard symbols are used to denote the various components, and standard device numbers denote the function of each device. 2) The schematic diagram shows the operating coils, respective contacts, and clearly illustrates the complete operation of a circuit. 3) The detail or wiring diagram shows the complete wiring, as well as the physical location of each device and where their contacts are in relation to their actual mountings.

Electricity. A man-made force that has no color, no odor, is not visible, cannot be heard,yet man can control it and make it perform work for him.

Ground. A conducting connection between an electrical circuit and earth. Some other conducting object can also serve in place of earth.

Ground resister. A resister connected in series with the transformer neutral (or to the derived neutral in the case of a delta system) and the ground wire for the purpose of limiting the fault current that would flow in case of a line-to-ground fault.

High voltage. Voltage levels greater than 1,000.

High voltage cables. The underground distribution system through which the 3-phase power conductors, shield wires, ground wires, and, more recently, pilot wires are bundled together, insulated, and covered with a suitable jacket. The outside diameter will vary from 2 in. to 4 in., depending on the voltage class, size of conductors, etc.

Insulation. Material which does not allow electrical current to flow through it. Examples are rubber, plastic, dry wood, glass and ceramics.

Intermediate voltage. Voltage levels from 661 to 1,000.

Kilovolt - Ampere (KVA). The product of volts times amperes divided by 1,000.

Kilowatt (KW). Kilo means 1,000 - hence 1 KW equals 1,000watts.

Load. The demand of a piece of electrical equipment for a certain amount of energy to perform its function, such as motors, heaters, lights, etc.

Low voltage. Voltage levels from 0 to 660.

Metering point. The place where the mining company actually receives power from the utility company for distribution and use as required.

Nips. Clamps that are used to top electricity from the trolley wire or feeder cable to the machinery that is used.

Oil circuit breaker. A protective device to automatically disconnect the power when an abnormal condition exists, such as a short circuit.

Power factor. The ratio of watts divided by volt-amperes (or kilowatts divided by kilovolt amperes) expressed in per cent. The closer the power is to 100% the more efficient is the system.

Power factor correction. Capacitors provide the most common form of correcting power factor to bring it toward 100%. If the power factor goes below a certain value, the coal company must pay a penalty to the utilities company.

Protective relays. These are devices that detect the abnormal conditions on a system and signal the breaker to open the circuit.

Rectifier. An electrical device that converts alternating current into direct current.

Resistance. The opposition to current flow, measured in ohms. For example, the larger the resistance in a circuit the less number of amperes will flow through it.

Resistance grounded system. A distribution system either high or low voltage, that limits the ground fault current to small values.

Single phase power. This system requires only two power conductors and is generally used for control, lighting, and small (less than 3hp) loads.

Selectivity. Branch lines protected in such a manner that if a fault occurs on a branch line it will not trip out the main breaker and shut down the whole operation.

Surge arresters. Arresters provide protection against overvoltage or transient spikes created by switching surges, lightning strokes, and various other means.

Three phase power. The system uses three hot wires and one ground wire and has three balanced voltages spaced 120 electrical degrees apart. This system requires less current, is more economical, and can handle greater power than single-phase power.

Transformer. An electrical device to step up or step down the voltage. (In mines, it willgenerally be step down.)

Trolley wire. A big copper conductor that is hung on insulators from the mine roof with DC current.

Utilization voltage. The voltage to be applied to a piece of electrical equipment.

Volt. (v) Potential difference - may be thought of as electrical pressure, or hydraulically speaking, it is the same as pounds per square inch of pressure.

Voltage regulators. Devices that are used to maintain a constant A-C voltage at the load.

Watt (w). A term of power, the product of volts times amperes. It is the energy developed to do a certain amount of work.

Wye (or Y or Star) connection. A type of connection used to connect electrical devices in a three phase configuration. For instance, a bank of three-phase transformers connected in wye has a neutral point available. In a wye connection, the line-to-neutral voltage is equal to the line-to-line voltage divided by 1.732. The line current equals the phase current.

Zig-zag transformer. A neutral deriving transformer that establishes the neutral required for the resistance grounded system.

TRANSPORTATION AND COMMUNICATION

TRANSPORTATION AND COMMUNICATION

I. INTRODUCTION
    A. Three Categories of Mine Haulage
        1. Face Haulage
        2. Intermediate or Secondary Haulage
        3. Main Haulage
    B. Animal Haulage
        1. History

II. TRACK HAULAGE
    A. Mine Car Types
        1. End-Dump Car
        2. Solid Baby Car
        3. Drop-Bottom Car
    B. Operation of Locomotive Mine Car Haulage
        1. Accidents
        2. Regulations
        3. Unsafe Acts
        4. Working Around Track Haulage
            a. Safe procedure
            b. Crossing
            c. Hazards
                1. Shelter holes
                2. Switching
                3. Trolley wire
                4. Trolley pole
    C. Trackless Haulage
        1. Rubber Tired Units
            a. Shuttle cars
            b. Tractor-trailers
            c. Scoops
            d. Articulated
        2. Conveyor Units
            a. Chain conveyors
            b. Shaker conveyors
            c. Belt conveyors
                1. Main or butt conveyor systems
                2. Mobile belt conveyor systems
    D. Other Haulage Systems
        1. Monorail systems
        2. Modular conveyor trains
        3. Hydraulic transport

III. TRANSPORTATION OF MINING PERSONNEL
    A. Entering and Leaving the Mine
        1. Check-in and check-out system
        2. Identification check
    B. Moving Men in the Mine
        1. Mantrips
            a. Track mounted
            b. Off-track
        2. Conveyor belts

        3. Combinations
        4. Hazards
        5. Federal regulation
        6. Safe procedures
            a. Mantrips
            b. Belts
    C. Hazards of Moving Equipment
        1. General hazards and safe procedure
        2. Booms
        3. Electrical hazards

IV. COMMUNICATION AND DIRECTIONAL SYSTEMS
    A. Use in traffic control
    B. Methods
        1. Underground phone
        2. Trolley phone
    C. Non-verbal communication
        1. Signs
        2. Labels
        3. Signals

TRANSPORTATION AND COMMUNICATION

Three Categories of Mine Haulage

OBJECTIVES:

1. The student will understand that when transportation is used to transport supplies down to the working section and to bring newly mined coal to the surface, it is referred to as "haulage".
2. The student will be able to state the relationship between the method of haulage used to the coal seam; height, mining methods used to extract the coal, capacity required, ease of handling, and haulage efficiency.
3. The student will describe three categories of mine haulage and give examples of equipment used in each category:

   a) face b) intermediate or secondary c) main

4. The student will compare the earliest methods of haulage used with that of today:

   a) animal b) mechanized

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 123-125.
2. MSHA Circular "Transportation and Communication" - Page 16.

PRESENTATION AND ACTIVITIES:

1. Lecture
2. Discussion

TRANSPORTATION AND COMMUNICATION

Track Haulage

OBJECTIVES:

1. The student will identify three types of mine cars and state the advantage or disadvantage in using each type.

   a) end-dump b) solid-body c) drop-bottom

2. After studying about accidents that can and do occur related to mine haulage, the student will be able to group the types of accidents into four categories:
   a) collisions between vehicles
   b) injuries to people resulting from collision with car, being crushed between two cars, or being crushed between roof and rib
   c) derailment
   d) runaway vehicles

3. The student will become familiar with federal and state laws relating to haulage safety.

4. The student will be able to list unsafe acts commonly encountered around track haulage.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 125-131.

2. MSHA Circular "Transportation and Communication" - Pages 16-20.

3. Coal Mining Reference Book - Pages 132-133.

4. Code of Federal Regulations, July 1978, 75.1403-10.

PRESENTATION AND ACTIVITIES:

1. Selected readings and discussion.

2. Fact sheet given to all students on haulage accident prevention.

TRANSPORTATION AND COMMUNICATION

Trackless Haulage
Other Haulage Systems

OBJECTIVES:

1. Given a fact sheet on off-track haulage accidents, the student will be able to identify physical and environmental hazards which can cause such accidents.

2. Given two trackless systems of haulage, the student will describe the equipment and how it is operated in each system.

   a) rubber-tired units   b) conveyor units

3. The student will become familiar with other transport systems.

   a) monorail   b) modular conveyor trains   c) hydraulic

RESOURCES:

1. MSHA Film - "Conveyor Belts - Be Careful".
2. Text - "Elements of Practical Coal Mining" - Pages 131-143.
3. MSHA Circular - "Transportation and Communication" - Pages 27-31.

PRESENTATION AND ACTIVITIES:

1. Fact sheet will be given to all students on haulage accidents.
2. Classroom discussion.
3. View film.
4. Assigned readings.

TRACK HAULAGE ACCIDENTS

Types of Accidents

1. Collisions between vehicles.
2. Injuries to people due to collisions.
3. Derailments.
4. Runaway vehicles.

Cause of Accidents

1. Defective mine cars.
2. Poor conditions.
3. Poor planning and obsolete componenets of the transportation system.
4. Inoperative or missing protective devices on track (particularly on grades.)

Unsafe Acts

1. Riding in an unsafe position.
   a. Riding in a car loaded with coal or supplies.
   b. Riding on the front bumper.
   c. Riding on the lead car of a pushed trip.
   d. Standing while operating a locomotive.
2. Getting on or off moving equipment.
3. Running ahead of a moving trip.
4. Not seeking refuge in a shelter hole.
5. Operating the trip at excessive speed.
6. Failure to communicate intentions.
7. Inattention of motorman, motorman's helper, or laborers.
8. Pushing trips on main haulage.

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TRANSPORTATION AND COMMUNICATION

Transportation of Mining Personnel
(Entering and Leaving the Mine)
(Moving Men in the Mine)

OBJECTIVES:

1. After viewing slides on check-in, check-out systems, the student will be able to list in proper sequence the procedures a miner must go through in checking in and out of the mine.
2. The student will become aware of the identification requirements each miner must meet before entering the mines.
3. The student will be able to describe two types of mantrips: track-mounted and off-track, sometimes referred to as "rubber-tired" mantrips.
4. After viewing a film and slide presentation, the student will select safe procedures for boarding and riding a mantrip from examples of safe and unsafe methods.
5. The student will identify potential hazards inherent in the transportation system.
6. The student will become familiar with state and federal laws relating to transporting personnel in and out of the mine.

RESOURCES:

1. Kentucky Mine Safety Training Program. Slides and cassettes. "Mine Emergency Plan, Check-In, Check-Out, Mantrip and Tram Procedures" - 4-1 "Riding & Crossing Belts" 4-2
2. MSHA Film - "Dangers Along Haulageway".
3. Coal Mining Reference Book - Page 132, 134-139.
4. MSHA Circular - "Transportation and Communication".
5. Code of Federal Regulations - July 1978, Revised Edition, 77.1600-77.1701

PRESENTATION AND ACTIVITIES:

1. View slides - discussion.
2. Pictures and diagrams - Check-in, check-out, mantrips.
3. View film - discussion

PERSONNEL TRANSPORTATION HAZARDS

Injuries due to or resulting from:

1. Falling out of or off moving equipment.
2. Body parts (arms, legs, elbows, etc.) hanging out of moving equipment.
3. Flying objects.
4. Touching power sources.
5. Traveling too fast.
6. Falling dust or roof material.
7. Collisions with people.
8. Runaway equipment.
9. Falling out of drop-bottom cars.
10. Running into rib, posts, etc.
11. Drivers of other vehicles not seeing yours.

CONVEYOR BELT ACCIDENTS

Causes

1. Working on the conveyor belt while it is operating.
2. Lack of guards or other protective devices.
3. Lack of crossover bridges.
4. Disregard for safety rules.

Causes of Fire

1. Poor maintenance.
2. Accumulation of coal and oil on or near the conveyor.
3. Missing or stuck roller.

Protective Devices

1. Mechanical equipment guards.
2. Emergency stop controls.
3. Spillage control.
4. Cascade controls.
5. Load sensing devices.

TRANSPORTATION AND COMMUNICATION

Transportation of Mining Personnel
(Hazards of Moving Equipment)

OBJECTIVES:

1. The student will be able to identify potential hazards related to moving equipment and safe work procedures to be followed when using that equipment.

   roof bolter   loader   continuous miner   boom
   cutter   auger miner

2. The student will describe electrical hazards relating to trolley wire and trolley pole and tell how to avoid and prevent accidents due to unsafe behavior.

RESOURCES:

1. MSHA Circular "Transportation and Communication".
2. Text - Elements of Practical Coal Mining - Pages 130-131.

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Pictures and diagrams. Discussion.
3. Assigned readings.

SAFE PROCEDURES FOR WORKING WHEN USING MOVING EQUIPMENT

1. Before starting to work with any equipment, make a thorough check to be sure that everthing is in proper working order. This includes a check of the trailing cables. "ANY MACHINE OPERATION WHICH DOES NOT FUNCTION PROPERLY REPRESENTS A POTENTIAL HAZARD."

2. Be extremely careful when using the controls of the roof bolter. There have been many cases in which the operator was pinned between the boom and the roof or rib due to the use of the wrong control or improper use of the controls.

3. When operating the roof bolter, be sure that the "panic" bar is operating properly. Check this at the beginning of the shift.

4. When operating a loader or continuous miner, make an extra effort to be aware of where your helper is located. If you are acting as a helper, be aware of what the operator is doing and where he is going so you do not get pinned between the machine and the rib or get hit by the boom.

5. If you are a part of a miner crew, avoid getting in a position which will result in your being crushed or pinned between the miner boom and rib.

6. When operating a miner, cutter, drill, loader, or auger miner, place yourself entirely inside the cab position and remain seated.

7. Be sure that the trailing cable is long enough and in a safe position.

8. When operating the continuous miner, be sure that you and the shuttle car operator understand each other's signals.

9. When operating the continuous miner or loader, be sure to tram the machine completely under supported roof before removing wedged materials.

OFF-TRACK HAULAGE

Causes of Accidents

The major causes of accidents include:

1. Defective equipment.
2. Adverse environment.
3. Lack of appropriate protective devices and warning signs.
4. Obstructed view.

Unsafe Acts

1. Inproper operation of equipment
   a. Excessive speed.
   b. Failure to face the direction of travel (for shuttle car operator).
   c. Parking equipment at dangerous locations (i.e., near curtains or trucks).
   d. Failure to shut off controls and set brakes on unattended vehicles.
   e. Failure to put controls in neutral and come to stop when changing seats.
2. Riding in an unsafe position. This includes:
   a. Standing on shuttle car decks.
   b. Failure to remain seated when car is moving.
   c. Riding inside shuttle car when the conveyor chain was not locked.
3. Operator inattention.
4. Inexperience of operators.
5. Failure to wear protective devices.
6. Using defective equipment.

TRANSPORTATION AND COMMUNICATION

Communications and Directional Systems

OBJECTIVES:

1. The student will recognize the importance of communication and directional systems used in the mine.
2. Given two methods of verbal communication used in the mine, the student will be able to determine when and where each should be used.
3. After viewing a slide presentation on the proper way of receiving information and answering questions, the student will state the importance of displaying a proper attitude.
4. After viewing pictures and classroom discussion, the student will be able to identify three methods of non-verbal communication used in the mine.

RESOURCES:

1. Kentucky Mine Safety Training Program - Slides and cassettes.
   "Effective Communications" 4-3
   "Cap Light Communication Signals or Flagging" 4-4
   "Two Way Communication Systems" 4-5
2. MSHA Circular - "Transportation and Communication" Pages 36-40.

PRESENTATION AND ACTIVITIES:

1. Lecture - Methods of Communication
   a) Verbal
      1. Two-way radio
      2. Telephone - trolley phone
   b) Non-Verbal
      1. Signs
      2. Labels
      3. Signals
2. Pictures - discussion.
3. View slides - discussion.

NON-VERBAL COMMUNICATION IN THE MINE

SIGNS AND LABELS:	"DANGER" Board	Warning Signs
	"ESCAPEWAY" Signs	
	Switches	Identification Labels
	Cables	
	Controls	
SIGNALS:	Use of hands and/or arms	
	Use of cap lamps	
	Use of equipment lights	
WARNING DEVICES:	Conveyor Belt Fire Alarms	
	Methane Monitoring Alarms	

GLOSSARY OF TERMS (Transportation and Communication)

Accident. Any unplanned event that results in personal injury and/or property damage.

Belt haulage. Transportation of men and material on a moving belt.

Crosscut. Passageway driven at right angles to the main entry to connect it with a parallel entry or air course.

Dispatcher. An employee who controls or keeps track of traffic on haulageways and informs underground workers by telephone when to move trains or locomotives.

Extensible belt. A conveyor belt which is capable of being lengthened or shortened while in use.

Haulage. Transportation of men and material.

Hazard. Any condition that may result in the occurrence of, or contribution to, an accident.

Mantrips. Vehicles designed to carry men to and from the work area. A man-trip may be of two types: a) track-mounted (tracked) or b) off-track (trackless).

Motorman. The man who operates a haulage locomotive.

Panic bar. A bar or lever which extends a sufficient distance on each side of a stop switch of self-propelled electric face equipment; accessible from all operating positions. It requires not more than 2 inches of movement and not more than 15 pounds of pressure for emergency deenergization of equipment.

Rib. The side of a pillar or wall of an entry.

Slip-switch. A switch located on the belt that opens the control circuit if the belt starts to stall or if there is excessive slippage.

Track gage. The distance between the rails, measured from the ball of one rail to the ball of the other.

Trackman. A worker engaged in putting railway tracks in place.

Trailing cable. A cable that slides along the trolley wire and is used to conduct power to mobile mining machines.

Transfer point. The point where one belt discharges into another belt.

MODERN MINING METHODS - UNDERGROUND
(Machines and Machine Maintenance)

MODERN MINING METHODS - UNDERGROUND

(Machines and Machine Maintenance)

- I. INTRODUCTION
  - A. Choice of Method
    - 1. The system selected needs to provide certain factors for a particular operation
    - 2. Factors to consider in choosing a method of mining
    - 3. Gathering the information needed in determining a method

- II. TYPES OF MINES
  - A. Drift
    - 1. Description and use
  - B. Slope
    - 1. Description and use
  - C. Shaft
    - 1. Description and use

- III. TYPES OF MINING SYSTEMS
  - A. Conventional
    - 1. Cutting of the coal
      - a. Cutting machine
        - 1. Types of machines and ways of cutting
        - 2. Procedure of cutting
        - 3. Maintenance and parts
        - 4. Safety
    - 2. Drilling of the coal
      - a. Drilling equipment
        - 1. Types of drilling machine
        - 2. Procedure of drilling
        - 3. Maintenance
        - 4. Safety
    - 3. Breaking of the coal
      - a. Explosives
      - b. Other breaking devices
    - 4. Loading of the coal
      - a. Loading machine
        - 1. Operation
        - 2. Safety
        - 3. Maintenance and parts
      - b. Hand loading
    - 5. Transportation of the coal from the face to the outside
      - a. Primary haulage
        - 1. Shuttle car
          - a. Operation
          - b. Safety
          - c. Maintenance and parts
          - d. Types
        - 2. Ram cars
          - a. Operation
          - b. Safety
          - c. Maintenance and parts

            3. Scoop
                a. Operation
                b. Safety
                c. Maintenance and parts
            4. Mobile belt unit
                a. Operation
                b. Safety
                c. Maintenance and parts
            5. Pan line
                a. Operation
                b. History
            6. Track haulage from face
                a. Operation
                b. History
        b. Secondary haulage
            1. Introduction
                a. Primary and secondary can be the same
            2. Belt
                a. Operation
                b. Methods and rules of installation
                c. Safety
                d. Maintenance and parts
            3. Track haulage
                a. Motors
                    1. Operation
                    2. Safety
                    3. Maintenance and parts
                    4. Types
                b. Coal cars
                    1. Operation
                    2. Safety
                    3. Maintenance and parts
                    4. Types
    6. Roof Support
        a. Roof bolter
            1. Operation
            2. Types
            3. Safety
            4. Maintenance and parts
        b. Timbering
            1. Description
            2. Procedure and rules
            3. Safety
    7. Personnel
        a. Typical work crew
        b. Duties
B. Continuous
    1. Introduction
        a. Description
        b. Purpose
        c. Differences and similarities between continuous and conventional mining
    2. Continuous miners
        a. Boring-type
            1. Description

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2. Purpose
3. Safety
4. Maintenance and parts

b. Ripper-type
   1. Description
   2. Purpose
   3. Safety
   4. Maintenance and parts

c. Milling or drum-type
   1. Description
   2. Purpose
   3. Safety
   4. Maintenance and parts

d. Personnel
   1. Typical work crew
   2. Duties

C. Longwall mining
   1. Introduction
      a. Description
      b. Purpose
      c. Differences and similarities between continuous and longwalling
   2. Types of machines
      a. Plow
         1. Description
         2. Safety
         3. Maintenance and parts
      b. Shearer
         1. Description
         2. Safety
         3. Maintenance and parts
      c. Personnel
         1. Typical work crew
         2. Duties

D. Shortwall mining
   1. Description
   2. Purpose
   3. Differences and similarities between shortwall and longwall mining

IV. MAINTENANCE

A. Introduction
   1. Importance
   2. The role each employee plays
   3. The need for a maintenance program
   4. The role good maintenance plays in safety

B. Preventive maintenance
   1. Description
   2. Procedure
   3. Importance

C. Repairing
   1. Need for an overall plan
   2. Qualified personnel
   3. Checks and balances
   4. Dedication to quality

V. DEVELOPMENT MINING (Advance Mining)

- A. Entries
  - 1. Number of entries
    - a. Requirements
    - b. Size
      - 1. Factors that determine size
    - c. Distance between entries
      - 1. Factors that determine distance
    - d. Types of entries
      - 1. Main
      - 2. Flats or butts
- B. Development plans
  - 1. For conventional, continuous, and shortwall
    - a. Room and pillar
  - 2. For longwall mining
    - a. Description

VI. RETREAT MINING

- A. Introduction
  - 1. Description
- B. Methods of retreat mining
  - 1. Open end
    - a. Description
    - b. Terms:
      - 1. Lift or slice
      - 2. Gob
      - 3. Open side or open end
      - 4. Weight shifting or riding over
      - 5. Pushout strip or push block
  - 2. Pocket and wing
    - a. Description and when used
    - b. Terms:
      - 1. Pocket
      - 2. Wing
  - 3. Splitting
    - a. Description and when used

VII. DESIGN OF PILLAR LINES

- A. Shape, size, number, production, and safety
  - 1. Hand loading
  - 2. Conventional mining
  - 3. Developing
  - 4. Retreat mining

VIII. PARTIAL MINING

- A. Description
- B. Conditions that dictate against full pillar recovery
  - 1. Mining rights
  - 2. State laws
  - 3. Mining conditions

IX. MINING TWO OR MORE SEAMS ON ONE PROPERTY

- A. Reasons for mining certain seams first
- B. Mining seams above and below a certain seam
  - 1. Problems that arise
- C. Columnizing when mining different seams

X. PITCHING SEAMS
   - A. Mining coal at 10% grade or below
   - B. Mining coal at 14% grade
   - C. Mining coal at 20% grade
     - 1. Longwall mining
     - 2. Hydralic mining

XI. LONG-RANGE PLANNING
   - A. Long range planning is essential
   - B. Proper planning must provide:
     - 1. A balance of development and retreat mining if on a full recovery system
     - 2. A balance of coal quality; if not uniform over the property
     - 3. A balance of mining conditions
   - C. Factors that may dictate a change in the ideal way to mine a property:
     - 1. Increased costs
     - 2. Higher capital expenditure
     - 3. Better quality
     - 4. Availability of cash

MODERN MINING METHODS - UNDERGROUND

(Machines and Machine Maintenance)
Choice of Method
Types of Mines

OBJECTIVES:

1. The student will be able to list factors that must be considered in selecting the best system for a mining operation.
2. The student will be able to list factors that must be considered in choosing a method of mining.
3. The student will be able to list sources of information personnel may use in making a choice of a mining method.
4. The student will be able to name and describe three types of underground mines.

   a) drift   b) slope   c) shaft

5. The student will be able to name mining compaines operating in the general area and determine what type of mines they are.

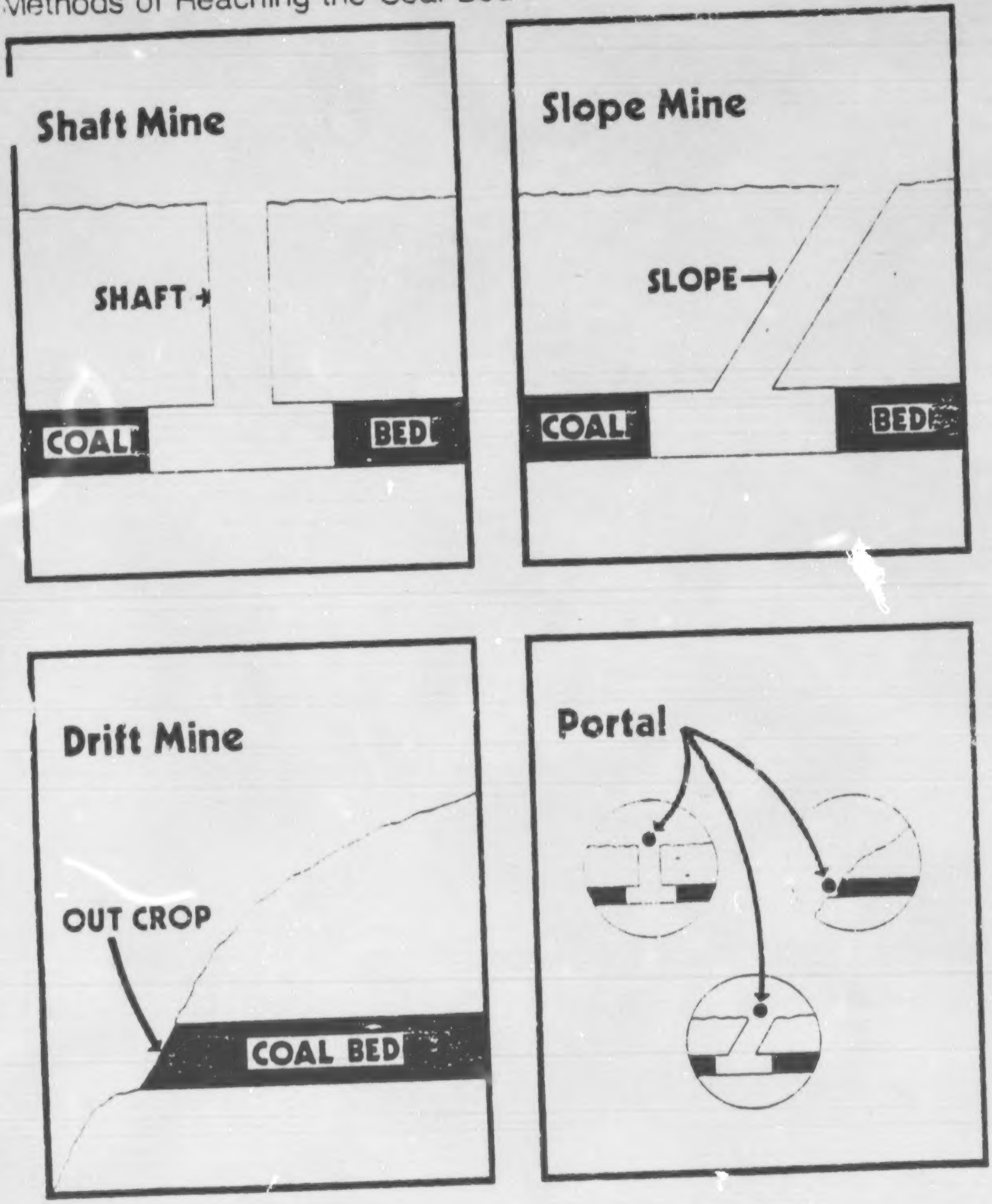
RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 347-349.

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Readings.
3. Research within the area to determine what types of mines are located in Harlan County.
4. Transparencies of types of mines. (Teacher made.)

Methods of Reaching the Coal Bed


Shaft Mine
SHAFT
COAL
BED
Slope Mine
SLOPE
COAL
BED
Drift Mine
OUT CROP
COAL BED
Portal

MODERN MINING METHODS - UNDERGROUND

Types of Mining Systems
Conventional

OBJECTIVES:

1. The student will be able to explain the sequence of operation in the conventional method of mining coal.
2. The student will be able to list the parts of a cutting machine and describe how it is used to extract the coal.
3. The student will be able to list safety percautions a miner must take in operating a cutting machine.
4. The student will become aware of the importance of proper maintenance of the cutting machine in relation to personnel safety and loss of coal production.
5. The student will be able to name three types of drills and describe drilling procedures used in preparing the face for coal extractions.
6. The student will become aware of the hazards involved in drilling procedures and how the face drill operator can prevent accidents.
7. The student will become aware of the importance of proper maintenance of the drilling equipment in relation to personnel safety and loss of production.

RESOURCES:

1. Text - Elements of Practical Coal Mining - page 350.

PRESENTATIONS AND ACTIVITIES:

1. Lecture - Diagrams - Pictures - Chalkboard.
2. Assigned readings.

MODERN MINING METHODS - UNDERGROUND

Types of Mining Systems
Conventional

OBJECTIVES:

1. The student will be able to explain the sequence of operation in the conventional method of mining coal.
2. The student will be able to list the parts of a cutting machine and describe how it is used to extract the coal.
3. The student will be able to list safety precautions a miner must take in operating a cutting machine.
4. The student will become aware of the importance of proper maintenance of the cutting machine in relation to personnel safety and loss of coal production.
5. The student will be able to name three types of drills and describe the drilling procedures used in preparing the face for coal extractions.
6. The student will become aware of the hazards involved in drilling procedures and how the face drill operator can prevent accidents.
7. The student will become aware of the importance of proper maintenance of the drilling equipment in relation to personnel safety and loss of production.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Page 350.

PRESENTATIONS AND ACTIVITIES:

1. Lecture - Diagrams - Pictures - Chalkboard.
2. Assigned readings.

MODERN MINING METHODS - UNDERGROUND

Types of Mining Systems
Conventional

OBJECTIVES:

1. The student will be able to describe methods used in breaking the coal loose from the face.
2. The student will be able to describe the operation of a loading machine.
3. The student will become aware of the importance of the maintenance of the loading machine in relation to personnel safety and loss of production.
4. The student will be able to describe two systems of transporting coal from the face to the outside.
5. The student will be able to describe the operation, parts, and the importance of maintenance of the shuttle car, ram car, and scoop.
6. The student will be able to describe the operation of conveyor belts to transport coal from the face to the outside.
7. The student will be able to distinguish between "track" haulage and "trackless" haulage.
8. The student will be able to classify each type of equipment used and method of transportation used by listing each under "track haulage" or "trackless haulage".

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 349-350, 304-313, 123-142.
2. Coal Mining Reference Book - Pages 131-133.
3. MSHA Transparencies - "Job Safety Guide Shuttle Car Operator".
4. MSHA Film - "Shuttle Car Operator".

PRESENTATION AND ACTIVITIES:

1. Lecture - Pictures - Diagrams.
2. Assigned readings.
3. Transparencies.

MODERN MINING METHODS - UNDERGROUND

Types of Mining Systems
Conventional

OBJECTIVES:

1. The student will be able to describe a roof bolting machine, its operations, and the importance of proper maintenance.
2. The student will be able to describe the procedures used in timbering for proper roof support.
3. The student will be able to identify general hazards and safety concerns associated with securing the roof for mining operations.
4. The students will be able to list personnel on a typical work crew and to describe the duties of each.

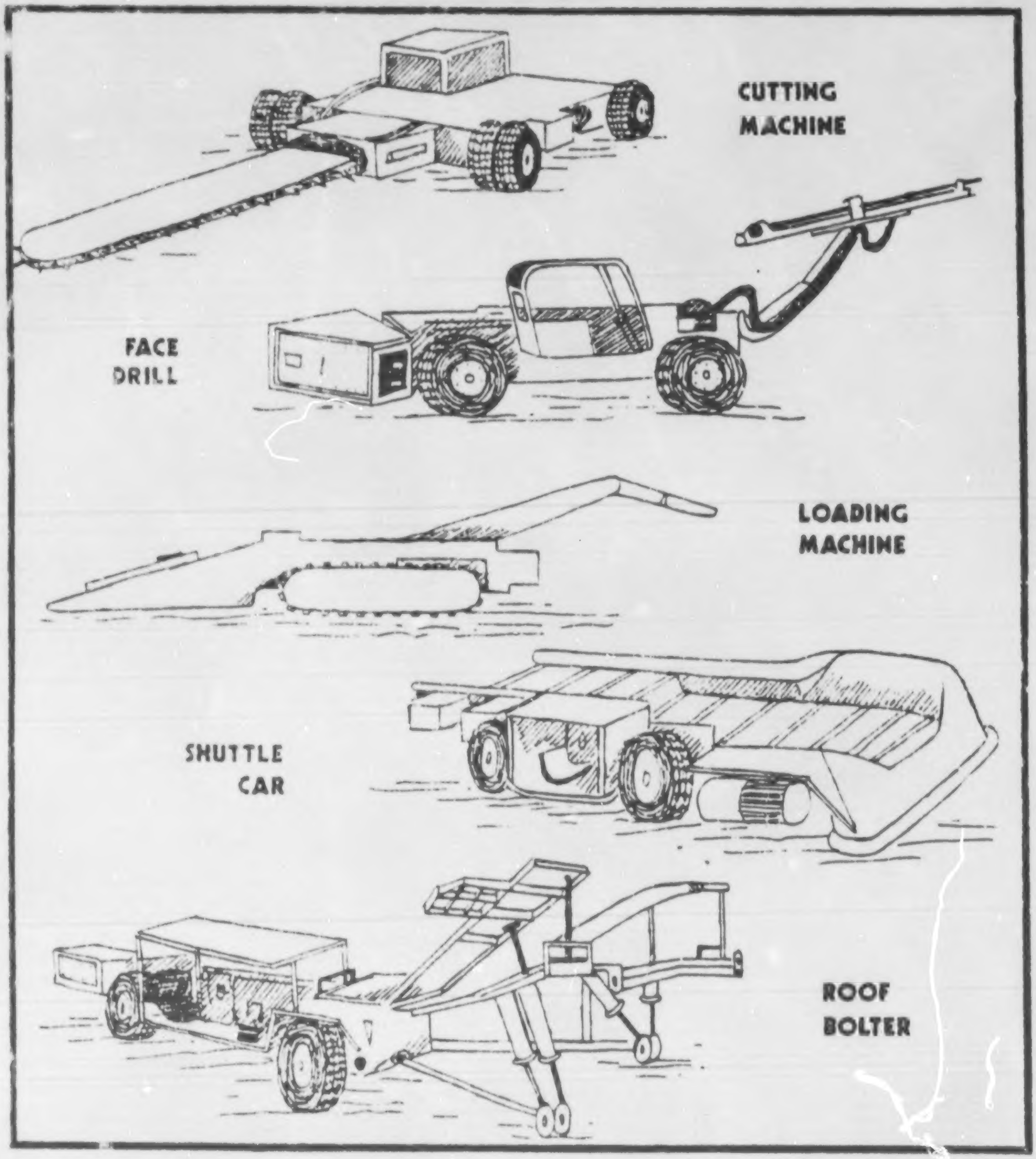
RESOURCES:

1. Text - Elements of Practical Coal Mining - Page 351.
2. MSHA Circular "Introduction to the Work Environment" Pages 19,38.
3. MSHA Transparencies "Job Safety Guide to Roof Bolting Operation."

PRESENTATION AND ACTIVITIES:

1. Lecture - Pictures - Diagrams.
2. Transparencies.
3. Assigned readings.
4. Research job opportunities - cutting machine operator, face drill operator, shot firer, loading machine operator, shuttle car operator, roof bolter, maintenance, and mine foreman.

Conventional Mining


CUTTING MACHINE
FACE DRILL
LOADING MACHINE
SHUTTLE CAR
ROOF BOLTER

MODERN MINING METHODS - UNDERGROUND

Continuous

OBJECTIVES:

1. The student will be able to state the differences between the conventional mining method and the continuous mining method.
2. The student will be able to name three types of continuous miners and describe the operation and proper maintenance of each.

   a) boring type b) ripper type c) milling or drum type

3. The student will be able to identify general hazards and safety concerns associated with the operation of the continuous miner.
4. The student will be able to list the personnel on a typical work crew and describe the duties of each.

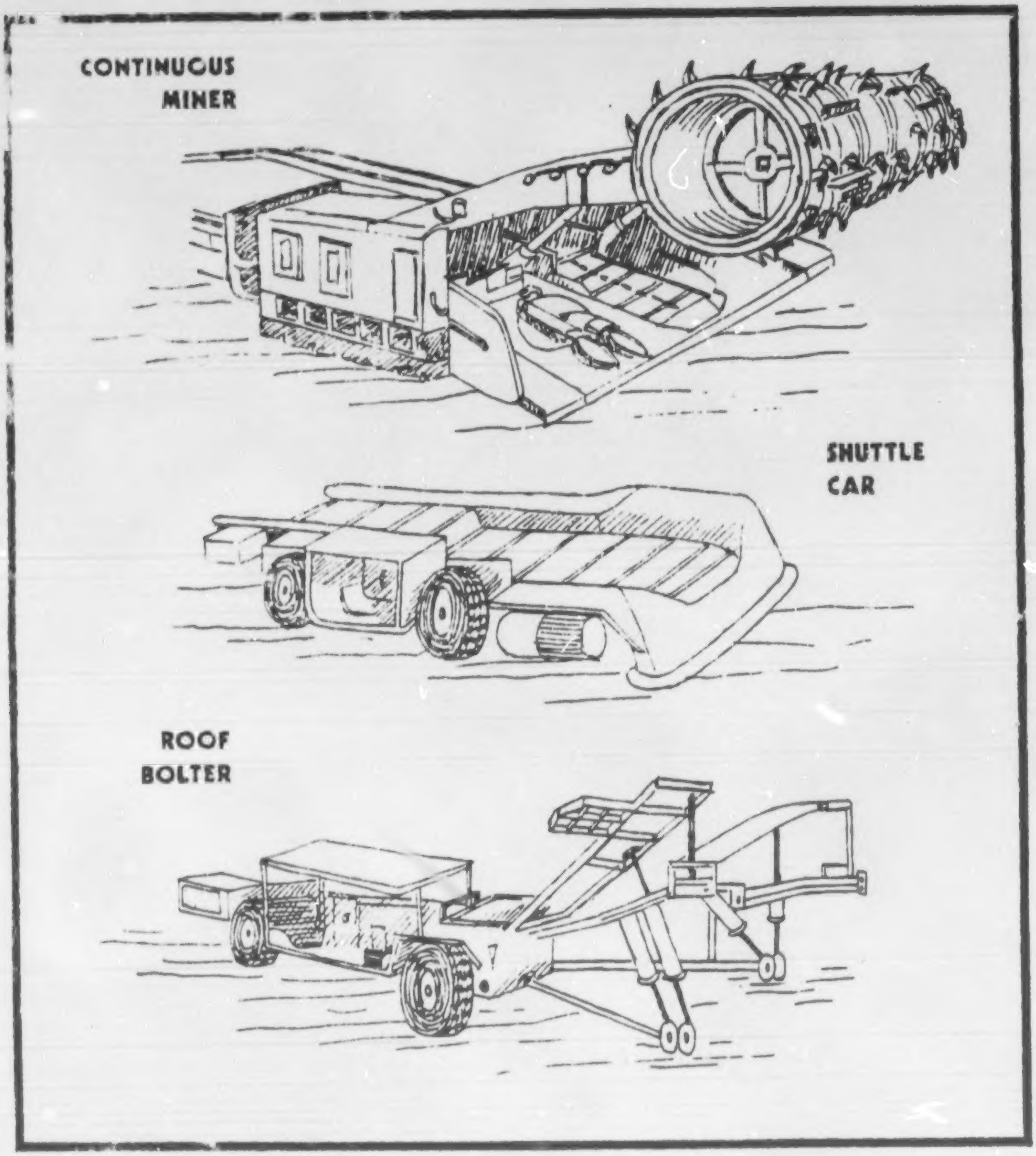
RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 352-353, 313-316.
2. MSHA Circular "Introduction to the Work Environment" Pages 20-21.
3. MSHA Transparencies - "Job Safety Guide Continuous Miner Operation".

PRESENTATION AND ACTIVITIES:

1. Lecture - Diagrams - Pictures.
2. Transparencies.
3. Assigned readings.
4. Research job responsibility - continuous miner operator.

Continuous Mining


CONTINUOUS MINER
SHUTTLE CAR
ROOF BOLTER

MODERN MINING METHODS - UNDERGROUND

Longwall - Shortwall

OBJECTIVES:

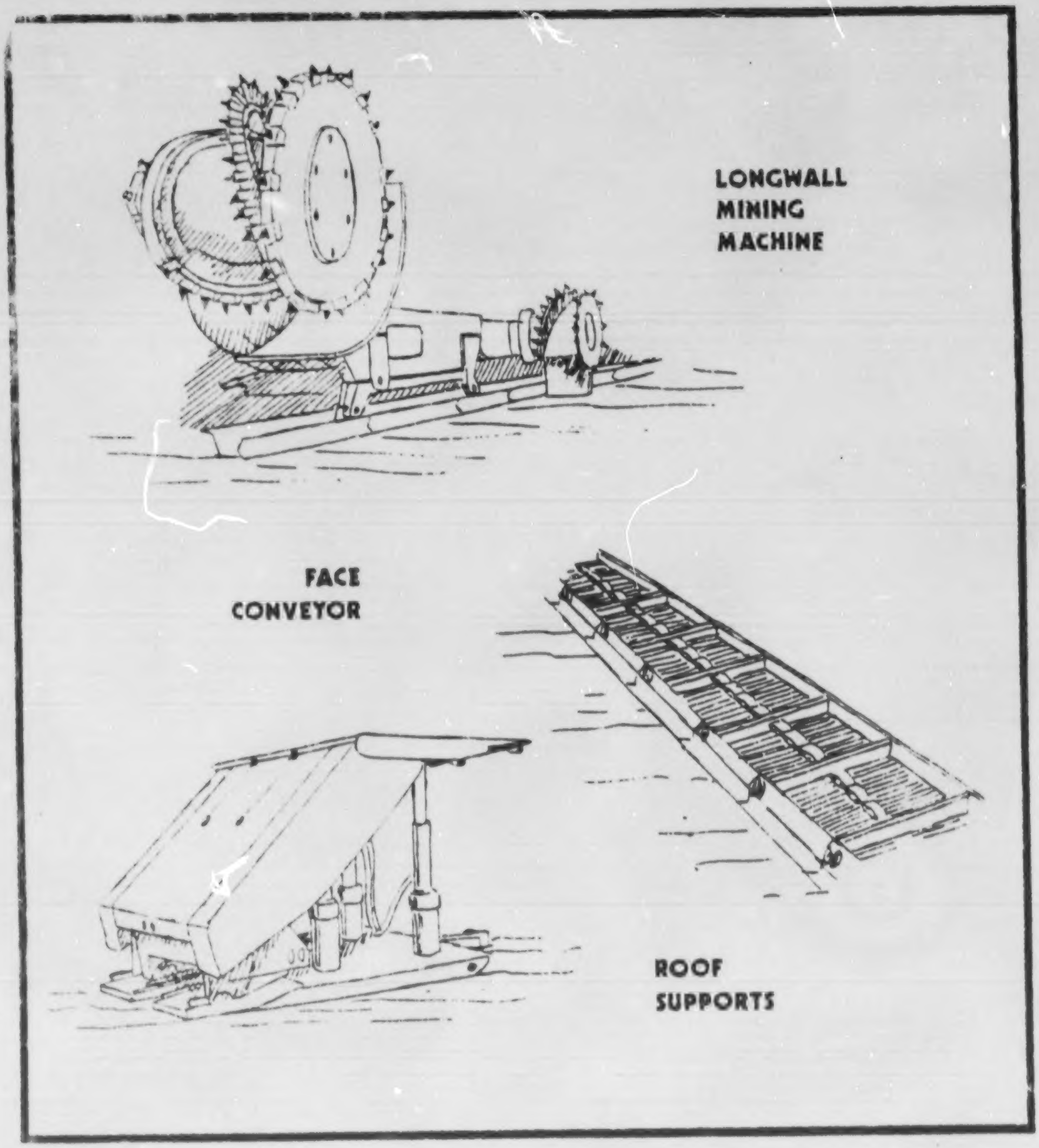
1. The student will be able to describe the longwall method of mining.
2. The student will be able to compare the similarities and diferrences among longwall, shortwall, continuous, and conventional mining methods.
3. The student will be able to name two types of equipment used in longwall mining and describe their operation.
4. The student will be able to list personnel on a typical working crew in a longwall and shortwall mining operation and describe the duties of each.
5. The student will be able to theorize why roof falls cause more injuries in longwall and shortwall mining than anything else.

RESOURCES:

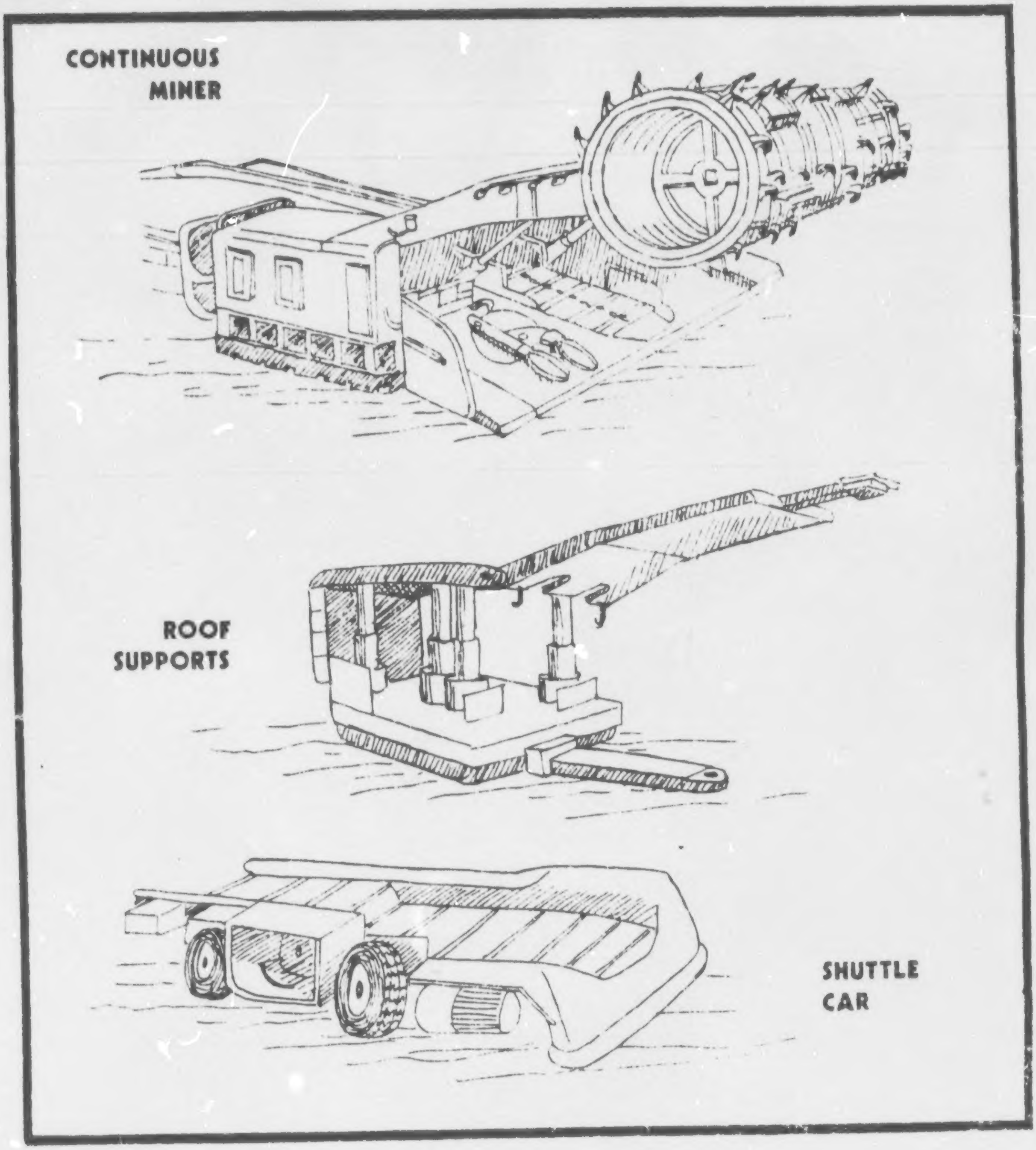
1. Text - Elements of Practical Coal Mining - Pages 352-356.
2. MSHA Circular - "Introduction to the Work Environment" - Pages 22-23, 27.

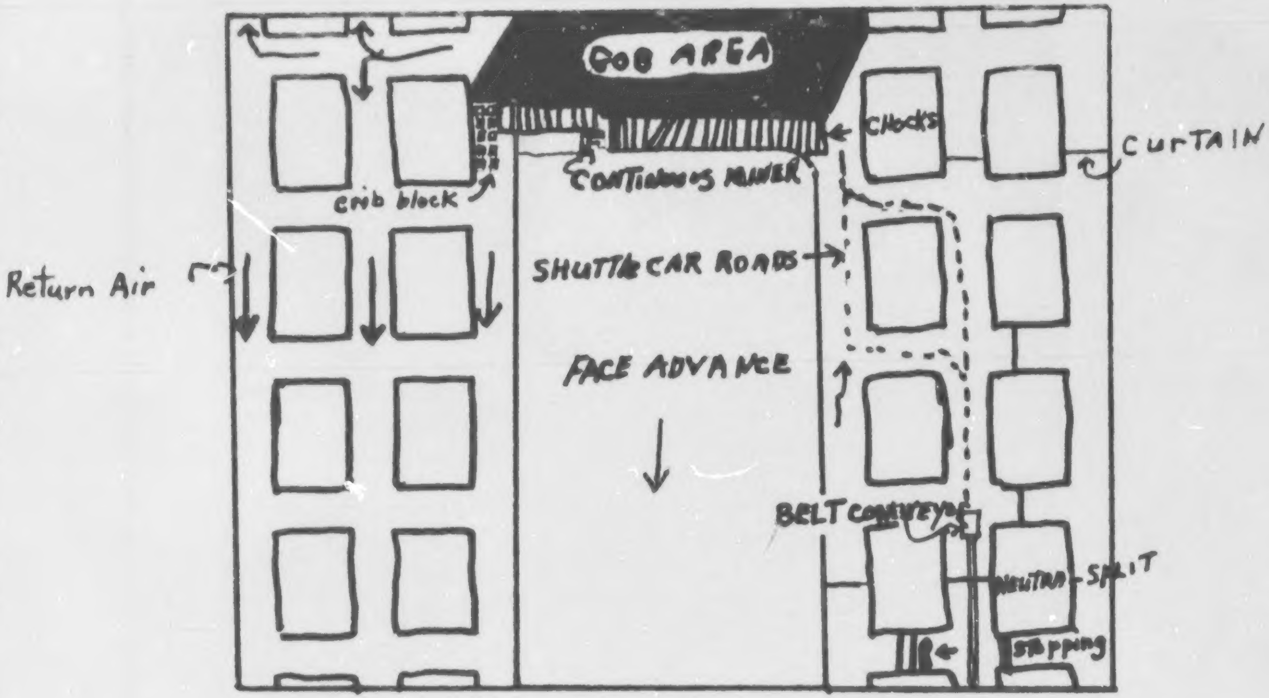
PRESENTATION AND ACTIVITIES:

1. Lecture - Pictures - Chalkboard - Diagrams.
2. Transparencies (teacher made).
3. Assigned readings.


LONGWALL MINING MACHINE
FACE CONVEYOR
ROOF SUPPORTS

Shortwall Mining


CONTINUOUS MINER
ROOF SUPPORTS
SHUTTLE CAR


GOB AREA
Chocks
Curtain
crib block
CONTINUOUS MINER
Return Air
SHUTTLE CAR ROADS
FACE ADVANCE
BELT CONVEYOR
NEUTRAL SPLIT
Stopping

N EXPERIMENTAL PLAN FOR SHORTWALL MINING NOW BEING PREPARED IN EASTERN KENTUCKY.

MODERN MINING METHODS - UNDERGROUND

Maintenance

OBJECTIVES:

1. The student will become aware of the need for an overall maintenance and repair plan.
2. The student will become aware of the need for qualified personnel who are dedicated to quality in the performance of their duties.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 293-320.

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Assigned readings.

MODERN MINING METHODS - UNDERGROUND

Development Mining (Advanced Mining)

OBJECTIVES:

1. The student will be able to identify three factors upon which the number of entries are determined.
    a) requirements: ventilation, haulage, escapeways, services such as power, water, and drainage.
    b) size
    c) distance
2. The student will be able to explain "room and pillar" development mining plan in conventional, continuous, and shortwall mining.
3. The student will be able to describe the development plan in longwall mining.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 357-358.

PRESENTATION AND ACTIVITIES:

1. Lecture - Diagrams - Chalkboard - Transparencies.
2. Assigned readings.

MODERN MINING METHODS - UNDERGROUND

Retreat Mining
Design of Pillar Lines
Partial Mining

OBJECTIVES:

1. The student will be able to explain what is meant by "retreat" mining or "second mining".
2. The student will be able to define: 1) lift or slice, 2) gob, 3) open-side or open-end, 4) push-out stump.
3. The student will be able to describe the "pocket and wing" and "splitting" methods of retreat mining.
4. The student will be able to determine how the design of pillar lines and the size and shape or the pillars, contribute to the greater production of coal, or create a loss in production.
5. The student will be able to identify conditions that dictate against full pillar recovery.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 358-362.

PRESENTATIONS AND ACTIVITIES:

1. Lecture - Transparencies (teacher made).
2. Use of charts and graphs.
3. Assigned readings.

MODERN MINING METHODS - UNDERGROUND

Mining Two or More Seams
Pitching Seams
Long Range Planning

OBJECTIVES:

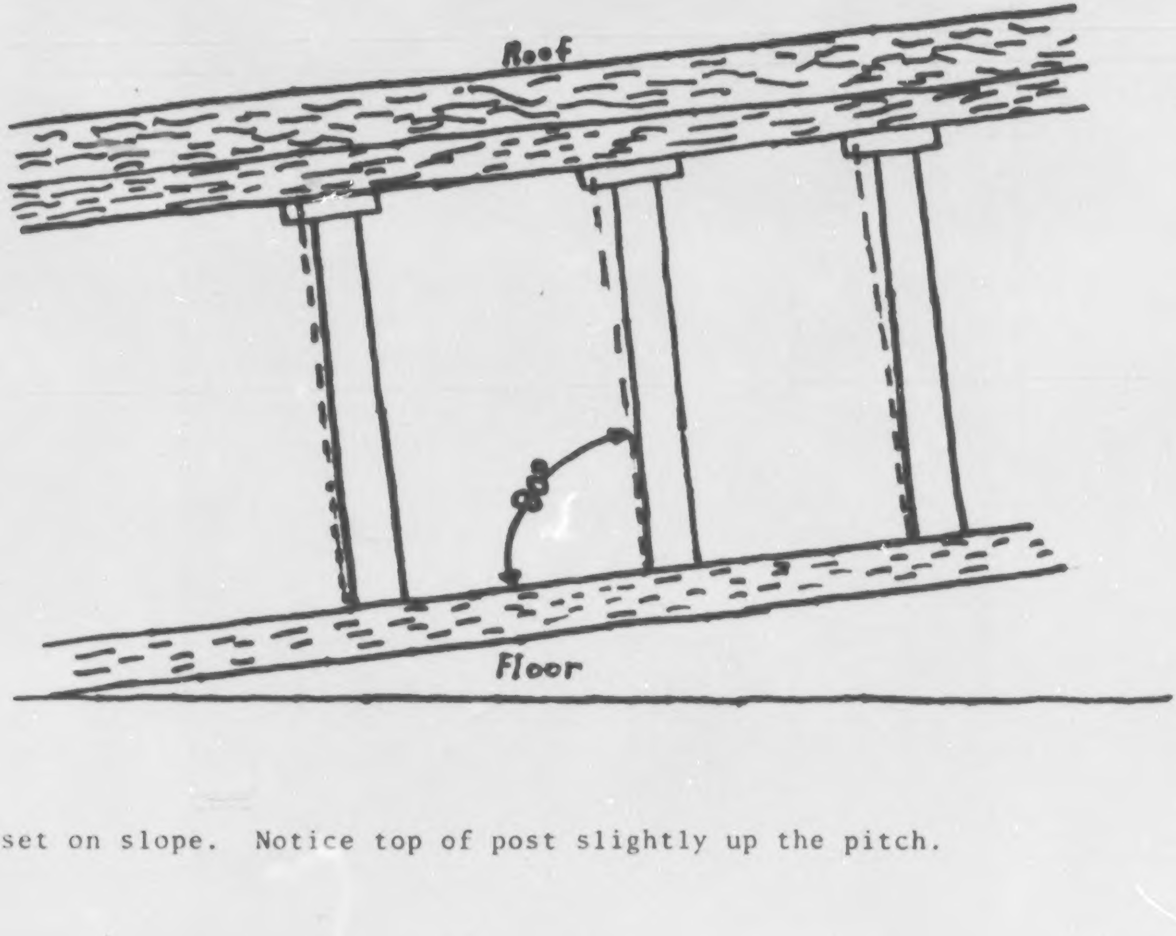
1. The student will be able to state the effect that mining on an upper seam could have on the mining of a lower seam on the same property.
2. The student will be able to identify the highest degree of pitch that conventional and continuous mining operations can still work with a high degree of efficiency.
3. The student will be able to list factors that must be considered in proper planning for an efficient mining operation.
4. The student will be able to analyze conditions that would dictate why the ideal way to mine a property is not always the best way for a given company.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 362-364.

PRESENTATION AND ACTIVITIES:

1. Lecture - Diagrams - Chalkboard.
2. Assigned readings.



Posts set on slope. Notice top of post slightly up the pitch.

MODERN MINING METHODS - UNDERGROUND

Field Trip

OBJECTIVES:

1. The student will be able to view actual underground mining operations, both conventional and continuous.
2. The student will be able to identify heavy equipment used in mining the coal and describe its operation.
3. The student will become familiar with model and experimental equipment being tested for both conventional and continuous mining methods.

RESOURCES:

1. On site visitation to the Jenny Mine at Prestonsburg, Kentucky.

PRESENTATION AND ACTIVITIES:

1. Preparation for field trip:
   a) Interviewing techniques
   b) Points of interest to look for:
      Ram car
      Shuttle car
      Continuous miner
      Cutting machine
      Roof bolting machine
      Scoop
      Loading machine
      Conveyor belts
      Personnel transportation
      Coal haulage
2. Field trip.

GLOSSARY OF TERMS (Modern Mining Methods - Underground)

Anthracite. A very hard coal. It has been under more pressure underground than any other type of coal.

Bituminous. A more developed soft coal than sub-bituminous. It has been under greater pressure and is darker and harder than sub-bituminous.

Coal bed. The area of coal underground that was once a peat bog.

Coal seam. The layer of coal underground covered by sediment layers.

Continuous mining. The mining method in which a continuous mining machine breaks coal from the face, gathers it, and loads it for transport.

Conventional mining. The mining method in which coal is undercut and blasted loose to be gathered for transport by machine.

Crosscuts. Short passageways driven at right angles to an entry. They connect one entry to another. (Also called "breaks")

Drift mine. A mine made where coal outcrops. Mining begins at the surface and goes directly into the coal seam.

Entries. The main passages driven into a coal seam as the mining operation advances.

Face. The actual area from which coal is being taken. (Also called "working face")

Floor. The bottom of an entry. (Also called "bottom")

Hand mining. The mining method using hydraulic drilling and cutting machines to mine coal and manual loading of coal.

Hard coal. A very hard coal (meaning it has been under great pressure underground) which burns without giving off many volatile waste products. Anthracite is the most common coal referred to as hard coal.

Headgate. The advancing roof support system and working area at the front of a longwall operation.

High coal. A thick coal seam that allows workers to stand up in the seam and also allows for the movement of large machines.

Inby-outby. Two essential terms which are used underground to describe a location in relation to the working face. Inby- towards the working face from a point. Outby- towards the shaft or entrance from a given point.

Intersection. The area in a mine where a crosscut or break intersects or connects with another entry.

Last crosscut The crosscut nearest the working face.

Lignite. A young coal, brown in color, that has been under pressure underground for a shorter time than the other types of coal. It has undergone the least change from peat.

Longwall mining. The mining method in which a large block of coal is isolated. Coal is mined from a very long face by a machine that moves along this face. Coal is hauled from the length of the face by a conveyor.

Low coal. A thin seam of coal where movement by miners is restricted by low roofs.

Main haulage system. The main means of transporting mined coal from the mine. The system is usually either conveyor belts, track haulage, or a combination of both.

Mule train. The oil and water resevoirs and hydraulic pumps needed to provide pressure to the system. It is located near the headgate entry.

Outcrop. When a coal seam appears at the surface of the earth.

Peat. Partially decayed plants that, when buried and placed under high pressure, forms coal.

Pillar. A large block of coal left by the development of entries and crosscuts. Pillars help support the mine roof.

Pillaring. The process by which pillars are removed as the mining operation retreats toward main entries. (Also called "retreat mining")

Pitch. The angle at which the coal seam inclines below the surface.

Portal. The entrance to the mine. Some mines have more than one portal.

Ribs. The sides of an entry.

Roof. The top of an entry. (Also called the "top")

Roof bolting. Refers both to the process and plan for safely securing a freshly cut roof so that work can proceed without roof collaspse. Holes are bored on pre-determined centers which correspond to the needs for safety. Steel bolts with anchors or synthetic resin are inserted and tightened. The roof bolt plan for a mine must be approved by MSHA.

Room. The area from the entry or crosscut to the face. (Also called "working place")

Section. Any working area in the mine where a crew of miners is mining and loading coal.

Shaft mine. A mine with a vertical tunnel to the coal seam.

Shortwall mining. The mining method in which a block of coal (smaller than the block in longwall mining) is isolated and mined by a continuous mining machine.

Slope mine. A mine with a sloping tunnel to the coal seam.

Soft coal. Refers to bituminous and sub-bituminous coals which are considerably softer and frequently contain sulfur and ash waste products.

Sub-bituminous. A type of coal similar to lignite but somewhat darker and harder. It has been exposed to more pressure than lignite.

Sulfur. Some sulfur occurs in most coals as pyritic sulfur (fool's gold). When coal is burned the sulfur produces an unwanted by-product.

Tailgate. The trailing roof support system and working area at the back of a longwall operation.

Tramming. The movement of equipment from one location to another.

DRAINAGE

- I. INTRODUCTION
  - A. Sources of Water In Mines
  - B. Reasons for Removal of Water
  - C. Mine Drainage and Pumping Consists Of:
    - 1. Prevention
    - 2. Collection
    - 3. Transportation
    - 4. Disposal

- II. PUMPS
  - A. Siphoning
  - B. Plunger Pump
    - 1. Operation
    - 2. Advantages and disadvantages
  - C. Submersible Pumps
    - 1. Operation
    - 2. Parts
  - D. Centrifugal
    - 1. Operation
    - 2. Types
    - 3. Advantages and disadvantages
  - E. Deep Well Turbine Pump
    - 1. Operation
    - 2. Purpose

- III. HEAD
  - A. Definition and Description
  - B. Vertical Head
  - C. Friction Head

- IV. PIPELINES AND FITTINGS
  - A. Pipeline Materials
    - 1. Steel
    - 2. Aluminum
    - 3. PVC
    - 4. Plastic
  - B. Grooved Coupling
    - 1. Description and application
  - C. Threaded Coupling
    - 1. Description and application
  - D. Valves
    - 1. Gate
    - 2. Foot
    - 3. Check

- V. PUMP AND PIPELINE INSTALLATIONS
  - A. Pumps and Pipelines
    - 1. Placement
    - 2. Installation of fittings, couplings, and valves
    - 3. Placements and use of different types of pumps
      - a. Plunger
      - b. Centrifugal

4. Permanent Pumping Stations
    a. Construction
5. Sump or Dam
    a. Construction and placement
6. Installation of Pump Lines
    a. Placement and temperature consideration
7. Mine Discharges
    a. Problems and solutions

DRAINAGE

Sources of Water - Reasons for Removal

Pumps

OBJECTIVES:

1. The student will be able to state the sources of water in the mines and the reasons for removal.
2. The student will be able to describe four methods of drainage and pumping.
   a) prevention b) collection c) transportation
   d) disposal
3. The student will be able to describe four types of pumps and be able to state the advantages and disadvantages of each.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 155-171

PRESENTATION AND ACTIVITIES

1. Lecture - Use of opaque projector to show illustrations and parts of different types of pumps.

DRAINAGE

Head - Pipelines and Fittings

OBJECTIVES:

1. The student will be able to define vertical head and friction head.
2. The student will be introduced to tables giving the friction head for various sizes and types of pipe at different rates of flow, also the resistance offered by valves and ells of different degrees.
3. The student will be able to describe the types of pipe used in the mines and to determine the type most commonly used.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 171-179.

PRESENTATION AND ACTIVITIES:

1. Lecture - Using charts: a) Friction Loss of Water per 100 Ft Length of Pipe, b) Determining the Capacity of a Pump.
2. Demonstration - The instructor will bring a coupling to class. He will instruct the class on the component parts and how it can be fitted to join two pipes together.

DRAINAGE

Pump and Pipeline Installation

OBJECTIVES:

1. The student will be able to state under what conditions each type of pump will be used, the proper place for installation, and whether it should be temporary or permanent.
2. The student will be able to determine under what conditions the flow of water coming from the mine could have on economic value to a small town near by.
3. The student will be introduced to the law governing pressure of liquids on surfaces.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 179-186

PRESENTATION AND ACTIVITIES

1. Readings
2. Lecture
3. Discussion

GLOSSARY OF TERMS (Drainage)

Centrifugal pumps - A pump which consists of an impeller or rotor with the intake at the center, so arranged that when rotated it will discharge water by centrifugal force into a casing which surrounds the impeller. The pressure developed by the pump is the result of the velocity given to the water by the impeller.

Deep well turbin pump - The turbin pump is driven by a motor on the surface connected by a drive shaft down the pipe column to the turbin assembly on the floor.

[illegible] - A sleeve curved at an angle for going around corners.

Friction head - Friction of the pipe to the passage of water.

Gate valves - Valves used to control the amount of water passing through a line.

Head - The vertical distance that water must be raised from where it is picked up to where it is discharged.

Plug or cap - A male or female devise for closing an open pipe.

Plunger pump - A pump that one or more cylinders through which a plunger is drawn, creating a vacuum. Atmospheric pressure forces the water up through the suction line, through a one-way valve (suction) into the pump cylinder. As the plunger reverses its direction, it forces the water in the cylinder through another one way valve (discharge).

Submersible turbine pump - The pump watertight motor is located at the bottom, powered through a shielded submarine cable running down in the borehole. The turbines are directly connected above the motor, taking the water and forcing it up the discharge pipe to the surface.

HEALTH AND SAFETY

Health

- I. INTRODUCTION

- II. DUST
  - A. Definition
  - B. Size of dust
  - C. Dangers of respirable dust
    - 1. Explosives (safety)
    - 2. Disease (CWP)
    - 3. Other health hazards
  - D. Limitations of respirable dust levels
  - E. Respirable dust exposure reduction
  - F. Control of respirable dust levels
    - 1. At the working face: ventilation
    - 2. On coal cars
    - 3. At surface mining sites
      - a. Water sprays
      - b. Vacuum cleaning techniques
  - G. Respiratory equipment
  - H. Periodic sampling
    - 1. When tests are made
    - 2. How they are made

- III. NOISE
  - A. General hazards
  - B. Types of noise
    - 1. Continuous
    - 2. Impact
    - 3. Impulsive
  - C. Hearing loss
    - 1. Nerve deafness
    - 2. Conductive loss
    - 3. Temporary versus permanent
  - D. Other health hazards
    - 1. Effects on circulatory system
    - 2. Effects on nervous, endocrine, reproductive systems
  - E. Effects of noise on the job
    - 1. Interferes with communication
    - 2. May be annoying
  - F. Noise level limitations
  - G. Noise control
    - 1. At the source (engineering)
    - 2. Change in acoustical environment (engineering)
    - 3. Change in relative position of source and listener (administrative)
  - H. Introduction of attenuating structures (ear protective devices)
    - 1. Earplugs
    - 2. Semi-insert plugs
    - 3. Earmuffs
    - 4. Helmets

Monitoring noise
1. When it is done
2. How it is done

III. OTHER HEALTH HAZARDS

IV. SUMMARY

SAFETY

I. ACCIDENTS IN THE U.S.
A. Injuries
B. Deaths
C. Among workers
1. In mining
2. In quarrying

II. WHAT IS AN ACCIDENT
A. What is an accident
B. Personnel injury or property damage results

III. BREAKDOWN OF CAUSES
A. Direct
1. Energy
2. Hazardous material
B. Indirect: unsafe acts or conditions
C. Basic
1. Management policies and decisions
2. Personal factors
D. Review

IV. HANDLING MATERIAL
A. Lifting procedures
1. In high coal
2. In low coal
B. Mechanical aids
C. Other procedures

V. COMMON MINE ACCIDENTS
A. Handling materials
1. Types of accidents
2. Safety rules
B. Slips and falls
1. Types of accidents
2. Safety rules
C. Machinery
1. Types of accidents
2. Safety rules
D. Hand tools
1. Types
2. Safety rules
E. Haulage

        1. Types of accidents
        2. Safety rules
    F. Other sources of accidents

VI. ORGANIZED ACCIDENT PREVENTION
    A. Responsibilites of top management
    B. General mine foreman's responsibilities
    C. Section foreman's responsibilities

VII. ACCIDENT PREVENTION POLICY
    A. Basic principles of accident prevention
        1. Establish potential and actual causes of accidents
        2. Eliminate the causes

VIII. SUMMARY

HEALTH AND SAFETY ASPECTS OF ASSIGNED TASKS - UNDERGROUND

I. 30 CFR is the Volume of Regulations Covering Health and Safety Standards for Underground Coal Mines
    A. Part 70 covers health standards
    B. Part 75 covers safety standards

II. IMPORTANT SUBPARTS OF PART 70
    A. Subpart B - Dust Standards
    B. Subpart F - Noise Standards

III. IMPORTANT SUBPARTS OF PART 75
    A. Subpart C - Roof Support
    B. Subpart D - Ventilation
    C. Subpart E - Combustible Materials and Rock Dust
    D. Subpart F - Electrical Equipment
    E. Subpart L - Fire Protection
    F. Subpart R - Miscellaneous

IV. HEALTH AND SAFETY CLASSIFICATION
    A. Health Standards cover hazards that can cause illness or disease
    B. Safety Standards cover hazards that can cause accident or injury

V. REGULATIONS COVERING TASKS IN 30 CFR
    A. Specific regulations and standards in 30 CFR are divided by part, subpart, and paragraph
    B. 30 CFR can be used to answer specific questions on miner tasks and health and safety standards

HEALTH AND SAFETY ASPECTS OF ASSIGNED TASKS

Surface

I. 30 CFR IS THE VOLUME OF REGULATIONS COVERING HEALTH AND SAFETY STANDARDS FOR SURFACE COAL MINES
   A. Part 71 covers health standards
   B. Part 77 covers safety standards

II. IMPORTANT SUBPARTS OF PART 71
   A. Subpart B - Dust Standards
   B. Subpart D - Noise Standards

IMPORTANT SUBPARTS OF PART 77
   A. Subpart B - Qualified and Certified Persons
   B. Subpart C - Surface Installations
   C. Subpart E - Safeguards for Mechanical Equipment
   D. Subpart F - Electrical Equipment
   E. Subpart K - Ground Control
   F. Subpart L - Fire Protection
   G. Subpart R - Miscellaneous

IV. HEALTH AND SAFETY CLASSIFICATIONS
   A. Health standards cover hazards that can cause illness or disease
   B. Safety standards cover hazards that can cause accident or injury

V. REGULATIONS COVERING TASKS IN 30 CFR
   A. Specific regulations and standards in 30 CFR are divided by part, subpart, and paragraph
   B. 30 CFR can be used to answer specific questions on miner tasks and health and safety standards

HEALTH AND SAFETY

Health
Respirable Dust

OBJECTIVES:

1. The student will be able to define "respirable dust".
2. The student will be able to describe how coal dust is measured.
3. The student will be able to explain the health hazards associated with respirable dust.
4. The student will be able to state the methods used in control of respirable dust at the mine.
5. The student will be able to determine when it would be necessary for a miner to wear a respirator.
6. The student will be able to describe monitoring devices used in the mine to sample dust content and to determine when and how often these tests must be made.

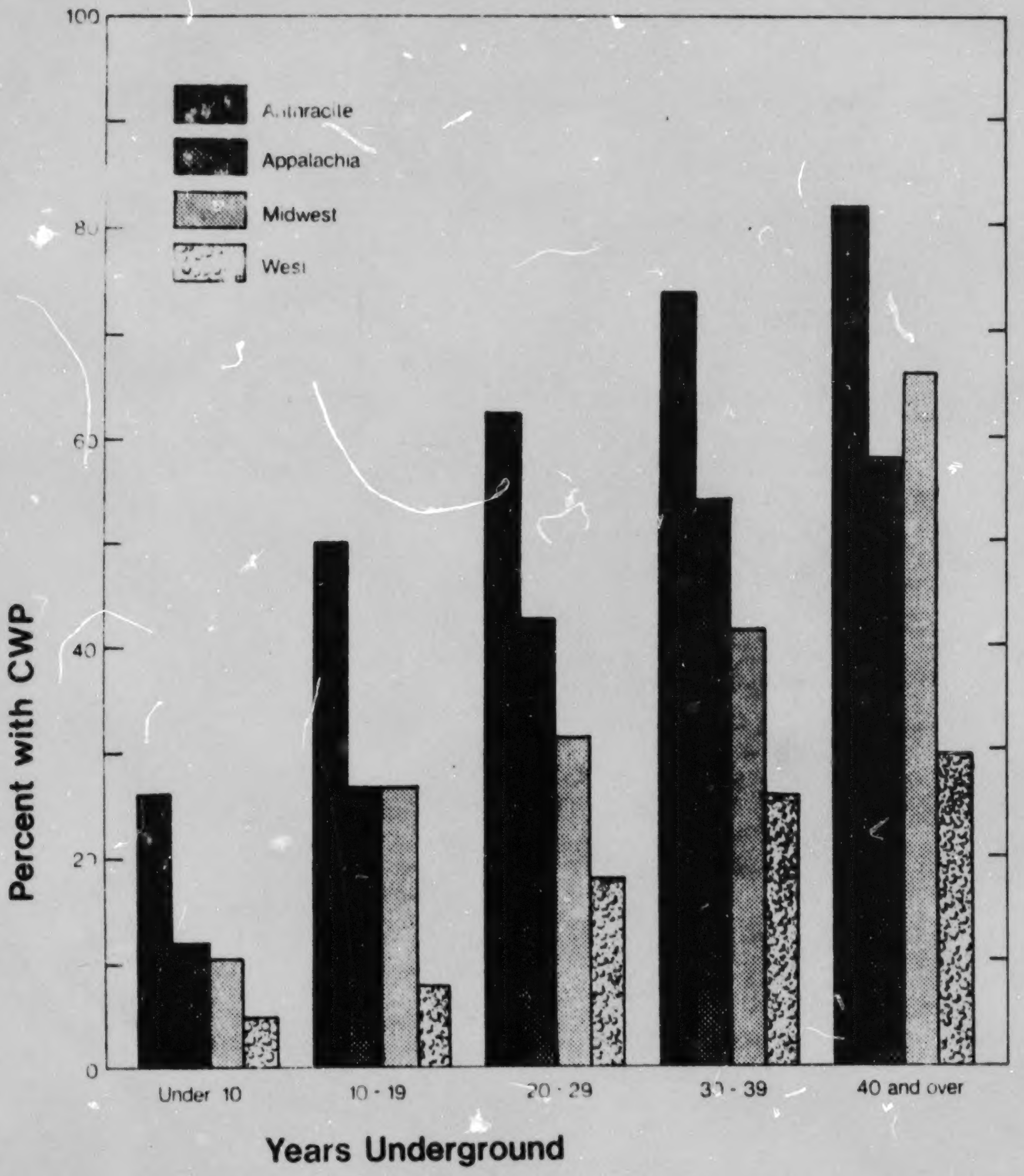
RESOURCES:

1. MSHA Circular " Health" - Pages 3-10.
2. MSHA Film - "Preventing Coal Pneumonconiosis Through Engineering Controls".

PRESENTATION AND ACTIVITIES:

1. View film.
2. Classroom discussion.
3. Display respirator - demonstrate how and when it is used.

Incidence of Coal Workers Pneumoconiosis (Black Lung)



HEALTH AND SAFETY

Health
Noise

OBJECTIVES:

1. The student will be able to explain health hazards associated with noise.
2. The student will be able to identify three specific kinds of noise and describe the kinds of hearing loss associated with each type.
3. The student will be able to explain how noise can have a detrimental effect on the circulatory system.
4. The student will be able to explain how the inability to hear may increase the probability of having an accident on the job.
5. The student will become familiar with permissable noise exposures in an eight hour shift in the mine.
6. The student will be able to categorize various ways of controlling noise into three categories.

   a) engineering b) administrative c) ear protectors
7. The student will be able to identify monitoring devices for noise control and determine when and how they will be used.

RESOURCES:

1. MSHA Circular " Health".
2. MSHA Safety Manual No. 14 - "Personal Protective Equipment".
3. MSHA Film - "Mining Noise Hazards in Underground Coal Mining".

PRESENTATION AND ACTIVITIES:

1. Hand out to students - noise levels.
2. Each student will receive safety manual "Personal Protective Equipment".
3. Use of transparencies (teacher made).
4. Lecture.
5. Assigned readings.
6. View film.

PERMISSABLE NOISE EXPOSURES

Duration Per Day (hours)	Noise Level (DBA)
8	90
6	92
4	95
3	97
2	100
1-1½	102
1	105
3/4	107
1/2	110
1/4 or less	115

HEALTH AND SAFETY

Safety
Levels of Accident Causes

OBJECTIVES:

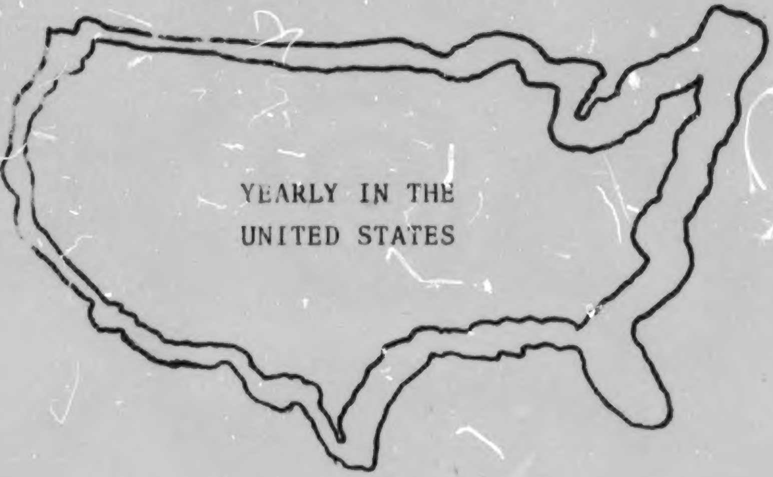
1. The student will be able to determine the leading causes of death in the United States.
2. The student will be able to define the term accident.
3. The student will be able to identify and give examples of three levels of accident causes.
4. Given an account of an accident in the mine, the student will be able to determine the conditions leading to the accident and why the accident occurered.

RESOURCES:

1. MSHA Circular " Hazard Recognition and Avoidance".
2. MSHA Film - "Management's Role in Health and Safety".

PRESENTATION AND ACTIVITIES:

1. Lecture - graphs - overhead projector.
2. Hand outs to students - Mine Accident, Accidents are the Leading Cause of Death Among Younger Workers, Yearly in the United States.
3. Discussion.


YEARLY IN THE
UNITED STATES

53 MILLION PERSONS ARE INJURED

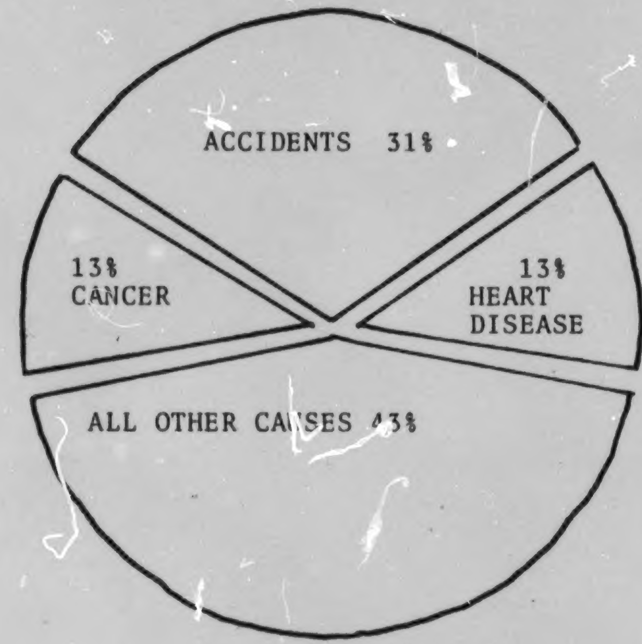
OF WHICH

40 MILLION ARE MEDICALLY TREATED

EACH YEAR THERE ARE 100,000 ACCIDENTAL DEATHS

50,000 MOTOR VEHICLE RELATED
30,000 HOME RELATED
14,000 OCCUPATIONAL, NON-MOTOR VEHICLE
9,000 OTHER

ACCIDENTS ARE THE LEADING CAUSE OF DEATH IN THE UNITED STATES AMONG YOUNGER WORKERS



DEATHS & INJURIES CAUSED BY ACCIDENTS AMONG U.S. WORKERS IN 1975

ACCIDENT	AT WORK	AWAY FROM WORK	TOTAL
FATAL	12,000	37,000	50,400
DISABLING	2,200,000	3,200,000	5,400,000
NONDISABLING	7,100,000	9,600,000	16,700,000

HEALTH AND SAFETY

Safety
Handling Materials

OBJECTIVES:

1. The student will be able to identify proper procedure for lifting and handling materials.

2. The student will be able to demonstrate the correct procedures for lifting in both high coal and low coal.

3. The student will be able to identify other procedures for handling materials other than by hand.

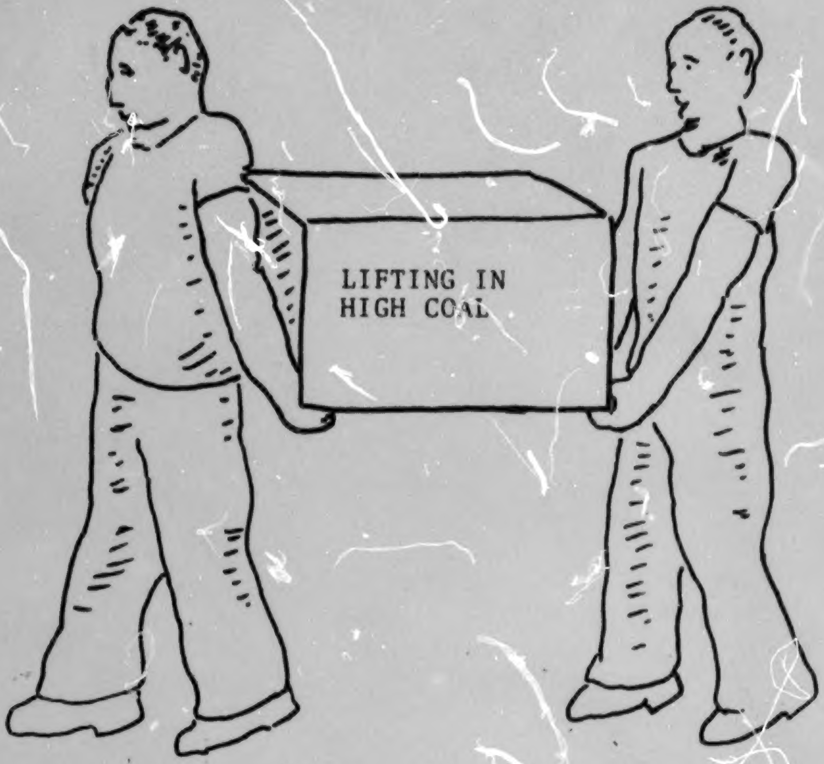
RESOURCES:

1. MSHA Circular - "Hazard Recognition and Avoidance".

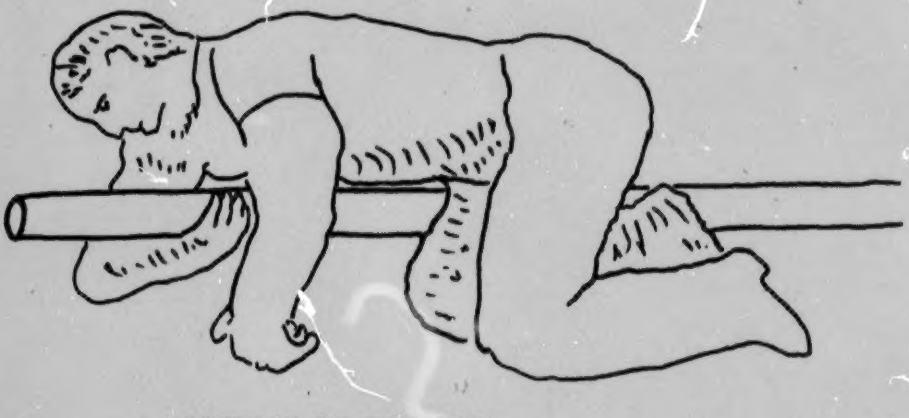
PRESENTATION AND ACTIVITIES:

1. Lecture - pictures and graphs.

2. Demonstration - instructor will demonstrate correct procedures for lifting. Each student will then go through same procedure.

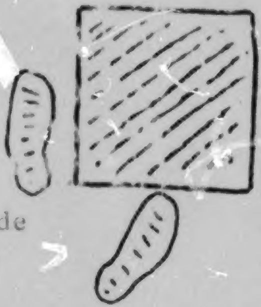

LIFTING IN
HIGH COAL

If the load is too heavy, get help.

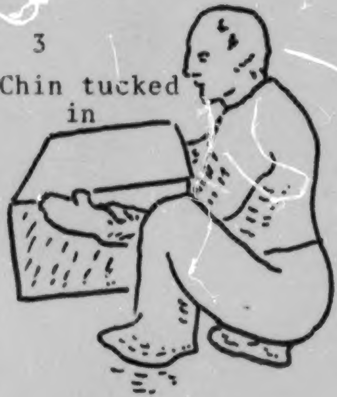


LIFTING IN LOW COAL:

On hands and knees, grasp object
with one hand, balance with other.



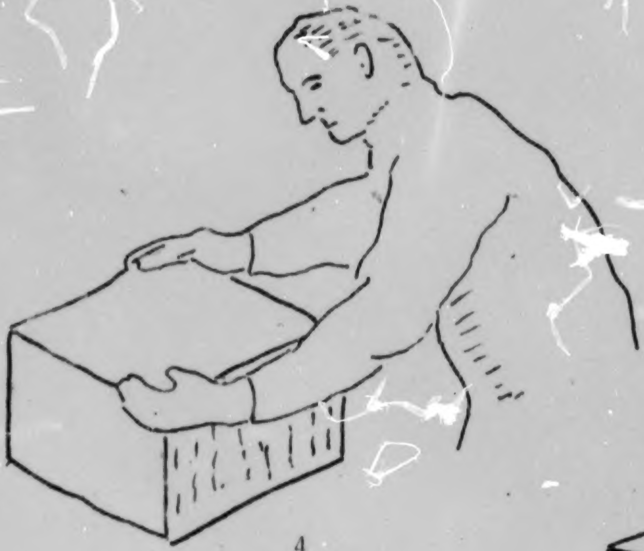
1
One foot to the side
One foot behind



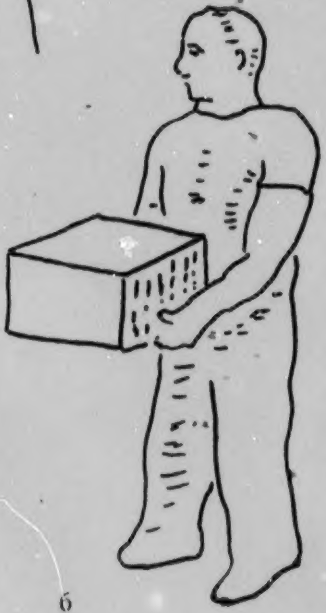
3
Chin tucked in

2
Back
Straight

Knees bent



4
Grip object with whole hand



5
Elbows
tucked in

6
Body weight directly over feet

LIFTING IN HIGH COAL

HEALTH AND SAFETY

Safety
Common Mine Accidents

OBJECTIVES:

1. The student will be able to list seven safety rules when handling materials.
2. The student will be able to list seven safety rules which will help to avoid haulage accidents.
3. The student will be able to identify safe practices which will help to avoid accidents involving machinery.
4. The student will be able to suggest ways in which accidents caused by slips and falls and hand tools could be avoided.

RESOURCES:

1. MSHA Circular - "Hazard Recognition and Avoidance".

PRESENTATION AND ACTIVITIES:

1. Hand outs to students - U.S. Coal Mine Accidents, 1977.
   U.S. Surface Coal Mine Accidents, 1977.
   Safety rules for : Machinery Accidents, Handling Materials Accidents, Haulage Accidents, Slips and Falls Accidents, and Hand Tools Accidents.
2. Lecture - instructor will refer to hand out sheets as material is discussed.

U.S. COAL MINE ACCIDENTS 1977

	ALL MINERS		NEW MINERS ONLY	
Total No. of Accidents	16,875		4,038	
Handling of Materials	4,941	29%	1,233	32%
Haulage	2,565	15%	519	13%
Machinery	2,209	13%	469	2%
Slips and Falls	1,705	10%	420	10%
Hand Tools	1,521	9%	374	9%
Fall of Roof	1,420	8%	332	8%

U.S. SURFACE COAL MINE ACCIDENTS 1977

	ALL MINERS		NEW MINERS ONLY	
Total No. of Accidents	4,721		2,228	
Handling of Materials	1,207	26%	527	24%
Slips and Falls	1,121	24%	443	20%
Machinery	741	16%	231	10%
Hand Tools	488	10%	172	8%
Haulage	429	9%	192	9%
Welding and Cutting	190	4%	118	5%
Falling Objects	127	3%	59	3%
Step or Kneel on Sharp or Loose Objects	116	2%	42	2%

SAFETY RULES - HAND TOOLS

1. Good housekeeping. Keep tools in their place.
2. When shoveling onto a belt, shovel in the same direction as the belt moves. (If you don't, a shovel which hits the belt may be thrown back at you.)
3. Always wear eye protection (safety glasses) to avoid injury by flying particles.
4. Don't improvise; use only the correct tool for the job.
5. Don't take dangerous short cuts when using hand tools.

SAFETY RULES - HANDLING MATERIALS

1. Wear glasses.
2. Wear safety glasses if there is a danger of eye injury.
3. Be careful of sharp edges.
4. Be certain what you carry does not obstruct your vision.
5. Be careful in holding the materials not to collide with the roof, rib, machinery, or other workers. Watch for jagged roof, rib, or bottom.
6. Be extra careful if you must pass through a door or a curtain.
7. Communicate clearly with anyone helping you so you coordinate your move.

SAFETY RULES - HAULAGE

1. If you are on foot, watch out for all vehicles.
2. Do not have your limbs or head out of the mantrip.
3. Never get on or off moving haulage of any kind.
4. Let the operator know you are near.
5. Flag the operator with your light.
6. Remember that most equipment can move backward as well as forward.
7. Know where the haulage equipment is likely to go (that is, in what direction and when and where it may stop or start).

SAFETY RULES - MACHINERY

1. Don't wear loose clothing or long hair that may get caught in rotating drills.

2. Avoid getting your hands between drill and the roof or rib.

3. While working around continuous miners and other face equipment, be sure the operator knows where you are at all times.

Stay away from booms.

Don't walk on moving conveyor belts.

6. Never get on or off or attempt to cross a moving belt.

7. Never ride on a conveyor belt when it is loaded with coal.

8. Don't wear long hair or loose clothing around conveyor belts.

9 Always wear safety glasses when riding a belt.

10. When tramming machines communicate with your fellow workers. Be sure to slow down and use appropriate warning signals at corners and check curtains.

SAFETY RULES - SLIPS AND FALLS

1. Use proper lifting techniques when handling materials.

2. Be extra careful when carrying material that reduces your visibility.

3. Wear proper footwear.

4. Always walk carefully and watch where you are going. (Be especially aware of mud, holes, water, and cables lying on the bottom.)

5. When hanging line brattice, don't improvise; use a ladder.

MINE ACCIDENT

Using the information given here, see if you can tell what caused this accident:

The day-shift production crew completed the shift and left the section at 2:30, but Owen and Palch stayed on to perform scheduled repair work during the shift change. When they finished (at about 3 p.m.) they left the working section in a jitney to go to the surface. Palch was operating the vehicle.

In another part of the mine, Bob Smith and Ted Jones, both motor operators, had been asked to begin their shift at 3 p.m.so they could take empty cars to the loading stations. They made up a trip of sixteen cars and, with Smith operating the front locomotive and Jones operating the rear locomotive, they traveled a short distance to the dispatcher's office.

There, Smith and Jones conversed with the day-shift dispatcher who gave them the right-of-way to travel along the main-line track. The jitney began its jouney along the main-line track shortly after 3 p.m. Ten minutes later Smith, in the lead locomotive, noticed a headlight on the track ahead of him--about 1,400 feet away. (At this location, the track system contained a slight grade to the decline, so Smith began the normal braking routine using the electric brake.) Smith said later that he hadn't been alarmed at seeing the headlight since he thought it belonged to a parked vehicle, and it was the usual procedure for vehicles to get in the clear at that location. So the trip continued on at its normal pace.

But at the same time Palch and Owen, who were traveling from the working area, also noticed a headlight. Palch later said that seeing the headlight didn't alarm him either, since it was routine to meet other personnel carriers along the track during shift changes, and he, too thought the headlight was that of a vehicle parked there. So the jitney continued along the track for about 275 feet.

At this point, however, Palch realized that the headlight was moving toward him quickly, and he saw a light signaling him to watch out. He stopped the jitney, and then reversed its direction of travel. Palch then yelled at Owen, who was in front of the trip, to jump from the vehicle with him. Palch later said that Owen apparently did not hear him, because he did not follow as Palch jumped from the vehicle as it drifted in reverse. The front locomotive had just passed Patch when the collision occurred.

At the time of the crash, the two motormen on the mantrip saw a headpiece fly into the air, but neither saw Owen.

The impact drove the jitney along in front of the trip for about 225 feet. Then the jitney hit a concrete form used as a foundation for roof supports. When the jitney hit this, the front locomotive was wrecked, and the trip came to a stop.

Smith, Jones, and Palch immediately made a search for Owen. They found him on the trolley wire side of the track partially under one of the empty cars. Upon examination, Owen showed no sign of life. Within minutes he was freed from the wreckage and the trip was broken to transport him to the surface. He was pronounced dead upon arrival at the hospital. Cause of death: extensive crushing-type injuries.

Here are some other facts that were noted when the accident was investigated. Read them carefully, because they will help you tell exactly what caused the accident.

The location along the main-line tract system where the accident took place provided good visibility, and the track itself was well kept up. The condition of the accident area and equipment involved were not factors which caused the accident.

This accident occurred in January, 1978. Before October of [illegible]7, all trips, except main-line trips which had to travel over the mine-track system during shift change, traveled without direction from the dispatcher. After October, all movement of traffic along the main-line system was controlled by the dispatcher.

The jitney operator had been off work during the time that this change in traffic control procedure was put into effect. He said that he did not ask for the right-of-way since no one had informed him that it was necessary to get information from a dispatcher for travel between shifts.

The locomotive operators with the empty trips and the dispatcher thought that the track system was clear since they'd not received a request for movement.

The jitney had a trolley phone, but examination at the scene of the accident showed that its volume control was in the "off" position.

At this mine, traffic control consisted of a dispatcher controlling vehicles only along the main-line system. Track traffic along section supply and mantrip tracks was not under his control. The dispatcher did not have a map, and he had to rely on memory to locate all track-mounted equipment. Those investigating the accident concluded that this was not a suitable method for keeping track of traffic underground.

HEALTH AND SAFETY

Organized Accident Prevention
Accident Prevention Policy

OBJECTIVES:

1. The student will be able to describe an effective accident prevention program which will include the responsibilities of top management.

2. The student will be able to identify the responsibilities of mine management in an effective accident prevention program which include the duties of the mine foreman and first-line supervisor.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 458-463.

PRESENTATION AND ACTIVITIES:

1. Lecture.

2. Assigned readings.

HEALTH AND SAFETY

Health and Safety Aspects of Assigned Tasks
Surface

OBJECTIVES:

1. Using Title 30 Code of Federal Regulations, Parts 71 and 77, the miner will be able to list the following subparts of Title 30 Code of Federal Regulations and the purpose of each:

SUBPART 71	PURPOSE
B	Dust Standards
D	Noise Standards

SUBPART 77	PURPOSE
B	Qualified and Certified Persons
C	Surface Installations
E	Safeguards for Mechanical Equipment
F	Electrical Equipment
K	Ground Control
L	Fire Protection
R	Miscellaneous

2. Given examples of regulations using the Title 30 Code of Federal Regulations, Parts 71 and 77, the student will be able to classify each of the regulations as health or safety standards.

3. Given copies of Title 30, Code of Federal Regulations, Parts 71 and 77, and a list of conditions or tasks at the mine, the student will be able to locate the applicable paragraph(s) which govern each task or condition.

RESOURCES:

1. MSHA Circular - "Health and Safety Aspects of Assigned Tasks".

2. Code of Federal Regulations, July Edition, 1978, Subparts 71, 77.

PRESENTATION AND ACTIVITIES:

1. Lecture.

2. Assigned readings.

3. Discussion.

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HEALTH AND SAFETY

Health and Safety Aspects of Assigned Tasks Underground

OBJECTIVES:

1. Using Title 30 Code of Federal Regulations, Parts 70 and 75, the student will be able to list the following subparts and the purpose of each.

SUBPART	PURPOSE
Part 70	
B	Dust Standards
F	Noise Standards
Part 75	
C	Roof Support
D	Ventilation
E	Combustible Materials & Rock Dust
F	Electrical Equipment
L	Fire Protection
R	Miscellaneous

2. Given examples of regulations using Title 30, Code of Federal Regulations, Parts 70 and 75, the student will be able to classify each of the regulations as health or safety standards.

3. Given copies of the Code of Federal Regulations, and a list of conditions and tasks in the mines, the student will be able to locate applicable paragraph(s) governing each task or condition.

RESOURCES:

1. Code of Federal Regulations, July 1978 Revised Edition.

2. MSHA Circular - "Health and Safety Aspects of Assigned Tasks".

PRESENTATION AND ACTIVITIES:

1. Lecture.

2. Assigned readings.

3. Classroom discussion.

GLOSSARY OF TERMS (Health and Safety)

Accident. Any unplanned event that results in personal injury and/or property damage.

Attenuating. Weakening or reducing.

Black lung (or coal workers pneumoconiosis--CWP). A chronic disease of the lungs caused by the inhalation of coal dust.

Cage. Mining term for elevator.

Conductive loss. Hearing loss caused by conditions which don't let sound waves pass from the outer or middle ear to the inner ear.

Contaminant. Something which fouls or impurifies (examples: dust, fumes).

Continuous noise. A noise that is constant.

Decibel (dBA). The measure of sound intensity. For humans it is measured in dBA units.

Frequency. The pitch or degree of highness or lowness of a sound.

Headpiece. A cap. (That is, a light and hat.)

Health standard. A regulation or requirement dealing with a mine hazard that could cause an illness or disease.

Impact noise. Noise that results from the impact (hitting) of one object with another.

Impulsive noise. Noise made when explosives are set off or a gun is fired.

Incidence rate. Rate of injury occurrence based on the number of injuries per 200,000 man hours. This is computed as follows:

$$IR = \frac{\text{number of injury occurrences}}{\text{hours of exposure}} \times 200{,}000$$

Intensity. The power or strength or force of a sound.

MRE instrument. An instrument for taking dust samples developed by the Mining Research Establishment of the National Coal Board, London, England.

Nerve deafness. A gradual loss of hearing within a specific frequency range caused by exposure to loud, continuous noise in that range.

Part. In a volume of regulations (such as 30 CFR), a part is a division of the regulations dealing with one general topic (such as health or safety).

Respirable dust. Any dust that is collected with an MRE instrument or other dust sampling device approved by the Secretary of Labor, and the Secretary of Health, Education, and Welfare. This is also dust that is capable of being breathed in.

Respirator. A device worn over the mouth and/or nose which removes contaminants (dust, fumes, smoke, poisonous gases) from the air you breathe, thus protecting the respiratory tract (lungs, bronchial tubes) from irritation.

Safety standard. A regulation or requirement dealing with a mine hazard that could cause accident or injury.

Severity measure. A measure of the severity of accidents based on the amount of time lost per 200,000 man hours. This is computed as follows:

$$SM = \frac{\text{sum of days}}{\text{hours of exposure}} \times 200{,}000$$

Subpart. A further division of a part. A subpart deals with a more specific topic included under a part. (For example, a part may deal with health. A subpart of that part may deal specifically with dust control requirements.)

MODERN MINING METHODS - SURFACE

MODERN MINING METHODS - SURFACE

I. INTRODUCTION

II. MINE DEVELOPMENT
  A. Development Drilling for Overburden
    1. Pupose of development drilling
    2. Types of drilling rigs
    3. Placement of drill holes
  B. Core Sampling and Testing
    1. Length and location of cores that are analyzed
    2. Tests that are made in laboratory on core samples
    3. Purpose of obtaining and analyzing the coal cores

III. PLANNING AND ENGINEERING DESIGN OF SURFACE MINES
  A. Pit Planning and Design
    1. Surveying
    2. Mapping
    3. Preparation plant
    4. Haulage rods
    5. Drainage of mining area
  B. Production Engineering
    1. Determining type of machinery
    2. Layout of the mining operation
  C. Land Reclamation
    1. Planning spoil deposition
    2. Placement of entrance roads

IV. TYPES OF SURFACE MINING
  A. Area Mining
    1. Favorable conditions
    2. Sequence of operation
  B. Contour Mining
    1. Favorable conditions
    2. Sequence of operation
  C. Open Pit Operation
    1. Favorable conditions
    2. Sequence of operation
  D. Mining Steeply Pitching Seams
    1. Determining the type of equipment to be used
    2. Sequence of operation
  E. Auger Mining
    1. Favorable conditions
    2. Sequence of operation

V. METHODS OF SURFACE MINING
  A. Shovel
    1. Sequence of operation
    2. Limitation of shovel
      a. Depth of cut
      b. Ability to stack the spoil
  B. Dragline
    1. Favorable conditions
    2. Sequence of operation

C. Bucket Wheel Excavator
  1. Sequence of operation
  2. Advantages and disadvantages
  3. Use as a helper machine
D. Bulldozer
  1. Favorable conditions
  2. Sequence of operation
E. Hydraulic
  1. Favorable conditions
  2. Sequence of operation
  3. Advantages and disadvantages
F. Scrapers
  1. Favorable conditions
  2. Advantages and disadvantages

VI. THE ELEMENTS OF SURFACE MINING
A. Drilling
  1. Factors determining type of drilling
  2. Types of drilling
    a. Horizonal
    b. Vertical
B. Blasting
  1. Factors that determine blasting procedure
    a. Type, location, and spacing of the strata in the area to be blasted.
    b. The degree of fragmentation to give optimum efficiency for the overburden machine.
    c. Proximity to populated areas or uncontrolled property.
    d. Amount of moisture in the overburden.
    e. Spacing and diameter of the drill holes.
    f. Vertical or horizonal drill holes.
C. Excavation
  1. Factors that will effect choice of excavating tools.
    a. Size or reserve to be mined.
    b. Rate at which production must be maintained.
    c. Type and character of the overburden.
    d. Thickness of the coal seam and depth of overburden.
    e. Whether the reserve area is contigous or is made up of widely separated mining areas.
    f. Reclamation plans and requirements
  2. Excavation machine
    a. Dragline
      1. Advantages
    b. Shovels
      1. Description
    c. Excavating wheel
      1. Description and advantages
    d. Crawler tractors and rubber-tired end loaders
      1. Description and advantages
D. Loading
  1. Progression of loading techniques.
  2. Factors that influence choice of loading equipment, size of machine, and number of units.
    a. Thickness of coal seam.
    b. Partings within the seam or between multiple seams.

    - c. Whether the product is sold raw or washed.
    - d. Whether blending upper and lower portions of the seam is desirable.
    - e. Type of preparation used in the pit, such as shooting, ripping, or loading off the solid.
    - f. Type and size of haulage equipment to be used.
    - g. Distance necessary to reach haulage trucks.
- E. Haulage and transportation
  - 1. Factors determining size and type of truck
    - a. Production rate required
    - b. Length of haul
    - c. Anticipated grades
    - d. Cycle time
    - e. Capacity of loading machines
    - f. Capacity of receiving hopper
    - g. Cost of operation
    - h. Initial cost
  - 2. Secondary haulage depends on:
    - a. Topography
    - b. Availability of right-of-way
    - c. Cost of constructing and maintaining haulage roads and truck costs over long distances
    - d. Life of operation
    - e. Total tons to be moved
  - 3. Maintenance
    - a. Preventive maintenance
- F. Spoil and Highwall Stability
  - 1. Introduction
  - 2. Definitions
    - a. Overburden
    - b. Spoil banks
    - c. Angle of respose
    - d. Slope
    - e. Box cut
    - f. Pit
    - g. Strip pit
    - h. Highwall
    - i. Slope failure
      - 1. Rock fall
      - 2. Plane shear
      - 3. Rotational shear
    - j. Ground control
      - 1. Sloping
      - 2. Benches
      - 3. Rockbolts
      - 4. Barriers
      - 5. Screens
      - 6. Baffle boards
      - 7. Scaling
    - k. Collaring a hole
    - l. Collar
    - m. Terrain
  - 3. Legal requirements
  - 4. Slope failure
    - a. Types
      - 1. Rock falls

        - 2. Plane shear
        - 3. Rotational shear
    - b. Indications of movement
- 5. Ground control methods
    - a. Sloping
    - b. Barriers
    - c. Screening
    - d. Baffle boards
    - e. Benches
    - f. Rockbolts
    - g. Drainage
    - h. Excavating
    - i. Boulders
- 6. Water hazards
- 7. Fedearl illumination requirements
- 8. Safe work procedures

Modern Mining Methods - Surface

Introduction - Mine Development

OBJECTIVES:

1. Given factual information as to the amount of coal mined from surface mining and underground mining from early 1900, the student will state reasons for the greater percentage of production of coal from surface operations.
2. The student will be able to state why there must be test drilling to determine overburden features and the type of equipment used for drilling.
3. The student will be able to determine how the results of care sampling and testing are used to decide the suitability of the coal field for power, gasification or metallurgical markets.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 377-383
2. Topographical, Relief and Geological Maps of Kentucky

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Use of maps - topography and geology of Eastern Kentucky.
3. Assigned readings.

MODERN MINING METHODS - SURFACE

Planning and Engineering Design of Surface Mines

OBJECTIVES:

1. The student will determine at what step the aerial mapping of the proposed mine site would be done, and what information will be gained from the mapping.
2. The student will state how the type of machinery that will be used is selected.
3. The student will become familiar with the land reclamation laws as they affect surface mining.
4. The student will be able to define "spoils" and describe how spoils can be kept uniform and aid in the reclamation efforts.

RESOURCES:

1. MSHA Film - "Safety in Suface Coal Mining."
2. Text - Elements of Practical Coal Mining ' Pages 383-386.

PRESENTATION AND ACTIVITIES:

1. View film - overall view of strip mining.
2. Classroom discussion.

MODERN MINING METHODS - SURFACE

Methods of Surface Mining

OBJECTIVES:

1. Given six methods of surface mining operations, the student will describe the equipment used in each type of operation and state the reasons why one type of equipment is better used for each type of mining operation than another.

   a) shovel b) dragline c) bucket wheel excavator
   d) bulldozer e) hydraulic f) scroper g) front-end loader

2. The student will identify potential hazards relating to moving equipment and safe work procedures that should be followed.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 394-408.
2. Kentucky Mine Safety Training Program - Trainee Handbook-Surface - Page 53.
3. MSHA Circular - "Transportation and Communication - Surface" Pages 31-41.

PRESENTATION AND ACTIVITIES:

1. Lecture - with use of pictures and diagrams of equipment.
2. Readings.

MODERN MINING METHODS - SURFACE

Types of Surface Mining

OBJECTIVES:

1. The student will be able to classify and describe conditions favorable for five types of surface mining.

    a) area mining b) contour mining c) auger mining
    d) steeply pitched seams mining e) open pit mining

2. The student will identify the various surface mines found in the immediate area.
3. The student will interview a resource person from a surface mining operation as to the job responsibilities, qualifications, and salary of personnel employed.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 386-394.
2. Kentucky Mine Safety Training Program - Trainee Handbook-Surface - Pages 46-52.

PRESENTATION AND ACTIVITIES:

1. Assigned readings.
2. Research area for types of surface mining operations.
3. Interview.
4. Resource person from surface mining operation.

MODERN MINING METHODS - SURFACE

The Elements of Surface Mining

OBJECTIVES:

1. The student will be able to identify factors that determine the type of drilling to be done.

   a) horizonal b) vertical

2. The student will be able to identify factors that determine blasting procedures.

3. The student will be able to identify factors that will effect the choice of excavating tools.

   a) shovels b) draglines c) wheel excavators
   d) crawler tractors e) front-end loaders

4. The student will identify factors that lead to the choice of loading equipment, size of machine, and number of units.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 408-416.

2. MSHA - Transparencies and Slides "Rubber-Tired Front-End Loader for Lift Truck Accident Prevention."

PRESENTATION AND ACTIVITIES:

1. Readings.

2. Diagrams and pictures.

3. Transparencies and slide presentation.

MODERN MINING METHODS - SURFACE

The Elements of Surface Mining
Haulage and Transportation
Maintenance

OBJECTIVES:

1. The student will be able to state the difference as to size and purpose between "off-road" haulage trucks and "on-road" haulage trucks.
2. Given statistics relating to accidents and fatalities with regard to truck haulage, the student will be able to determine the environmental and physical conditions that contributed to the accidents.
3. The student will state the conditions that would necessitate a secondary haulage system.
4. The student will be able to determine the advantage of a good prevention maintenance program over a "as it happens" maintenance repair.

RESOURCES:

1. Text - "Elements of Practical Coal Mining" - Pages 416-418.
2. MSHA Circular - "Transportation and Communication - Surface" - Pages 13-19.
3. MSHA Film - "Safety on the Move: Truck Haulage Safety".

PRESENTATION AND ACTIVITIES:

1. Readings.
2. Lecture - pictures and diagrams.
3. Classroom discussion.
4. View film - discuss accidents and safety procedures as portrayed in the film.

MODERN MINING METHODS - SURFACE

Spoil and Highwall Stability

OBJECTIVES:

1. The student will be able to define basic terminology needed to interpret a surface mine ground control plan.
2. The student will become familiar with federal laws regarding safe control of all highwalls, pits, and spoil banks.
3. The student will be able to list three of the most serious hazards surface miners face and describe each.

   a) rock falls b) plane shears c) rotational shear

4. The student will be able to describe ground methods used in surface mines to prevent or to control slope failures.
5. The student will become familiar with federal laws governing the illumination of surface mines.

RESOURCES:

1. Code of Federal Regulations, July 1978, Revised Edition, Subpart K - 77.1000, 77.1004, Subpart R 77.1713, Subpart C 77.207.
2. Text - Elements of Practical Coal Mining - Pages 419-422.
3. MSHA Circular - "Ground Control" - Pages 3-13.

PRESENTATION AND ACTIVITIES:

1. Study glossary of terms.
2. Readings.
3. Lecture and discussion. Use of a ground control plan. Students will write a sample plan (See handout).

SAMPLE GROUND CONTROL PLAN
(Section 77.1000)

1. Mine Name & Location ____________________ MSHA I. D. No. __________

____
County State

2. Company Name & Address ____

____

____

3. Officer in Charge of Health & Safety ____________________________
Name Title

4. Mine Coal Seam(s): Name ______________________ Height __________

5. List of Equipment Used in Mining (Number, Manufacturer, Model):

__________________________________ __________________________________

__________________________________ __________________________________

__________________________________ __________________________________

__________________________________ __________________________________

__________________________________ __________________________________

6. Method of Mining ____

7. Pit Information:
   A. Slope of Ground to be Mined _______ (Minimum) - _______ (Maximum)
   B. Average Highwall Height and Angle _____ (Feet) _____ (Degrees)
   C. Width and Spacing of Benches, If Used _____ (Ft. Width ___ (Ft. Spacing)
   D. Average Pit Width ______________ (Feet)
   E. Maximum Height & Angle of Deposited Spoil ___ (Feet) ___ (Degrees)
   F. Describe the Methods & Equipment Used to Scale and Maintain Highwall:

   ____

   ____

   ____

8. Additional Information (If Available):
   A. Topographic Maps Showing Location of Pits and Proposed Mining.
   B. Drawing Showing Methods of Mining and Means of Stabilizing Spoil.
   C. Blasting Plan Showing Drill Hole Spacing, Typical Loaded Drill Hole, and Sequence of Drill Hole Detonation.

Mine Company Official ________________________ Date __________

GLOSSARY OF TERMS (Modern Mining Methods - Surface)

Angle of repose. The natural angle or slope at which a given material will come to rest when it is free-piled, poured, or dumped.

Auger. A horizonal drill which bores holes into the coal seam much like a carpenter's drill, removing coal through a hole in the auger bit.

Baffle board. A method of ground control in which timbers are installed to reinforce different layers or terraces of ground.

Bench. A ledge, small terrace, or section of floor on a steep hillside or highwall.

Bucket. A tub or scoop for hoisting or conveying material (as a front-end loader or aerial tramway).

Bulldozer. A tractor like vehicle with a blade mounted in front used to clear land, strip top soil/overburden, build roads, or to do excavating.

Box cut. The first cut made in a tract of land to be surface mined.

Collar. The front or top of a drill hole.

Collaring a hole. Causing the drill bit to begin entering the rock.

Dipper. A digging bucket rigidly attached to a stick or arm on an excavating machine.

Dragline. A type of excavating equipment which casts a rope-hung bucket a considerable distance, collects the dug material by pulling the bucket towards itself on the ground with a second rope, elevates the bucket, and dumps the material on a spoil bank, in a hopper, or on a pile.

Drill. A mobile-type drill used to drill blasting holes in overburden.

Embankment. An artificial ridge of earth and broken rocks.

Front-end loader. A tractor loader with a digging bucket mounted and operated at the front-end of the tractor.

Ground control. Techniques used to prevent or contain slope failures.

Highwall. The man-made cliff left standing as the surface mining process continues.

Overburden. The soil and rock covering the coal.

Plane shear. A type of slope failure that occurs in highwalls distinguished by strata, or layers, of different kinds of material; slope failure along a plane of weakness in which a wedge-shaped chunk breaks free and falls.

Rock fall. A type of slope failure in which boulders break loose along planes, or areas, of weakness in rock formations.

Rockbolt. A long, self-locking steel bolt, or a grouted wood or plastic rod, used to pin less competent rock to firm rock for additional support.

Rotational shear. A type of slope failure in which material of the same composition throughout a slope or cliff breaks loose in a dish-shaped pattern.

Screening. A ground control method in which fencing is rock-bolted to the highwall, where it traps material that breaks loose.

Shot. Detonating a round of explosives.

Shovel. An excavating and loading machine consisting of a digging bucket at the end of an arm suspended from a boom.

Slope. The slant or incline of a surface.

Slope failure. When part or all of a spoil bank or highwall collapses.

Spoil bank. The area where mine waste or spoil materials are disposed of or piled.

Stemming. The noncombustible material used on top or in front of an explosive charge.

Strip pit. The surface mine work area.

Terrain. The lay of the land.

FIRST AID

I. INTRODUCTION
  A. Personal Injury Accidents
    1. Human psychological reasons for accidents
  B. Reasons for First Aid Training
    1. Developing awareness for hazards
    2. Aiding the injured or ill
  C. The Six Fundamentals of First Aid:
    1. Artifical respiration
    2. Control of bleeding
    3. Physical shock
    4. Wounds and burns
    5. Fractures and dislocations
    6. Transportation
  D. Five Principle Aims of First Aid:
    1. Prevention of further injury
    2. Treating life-threatening conditions
    3. Protecting injuries from infections and complications
    4. Making the injured as comfortable as possible to conserve strength
    5. Transporting the injured person to medical assistance

II. RESPONDING TO AN EMERGENCY
  A. Taking Charge
  B. Attending Injuries In Order Of Seriousness
    1. Impaired or stopped breathing
    2. Severe bleeding or loss of heart function
    3. Shock
    4. Open wounds and burns
    5. Fractures
    6. Transportation

III. THE HUMAN ANATOMY
  A. The Head
  B. Trunk
  C. The Extremities

IV. IMPAIRED OR STOPPED BREATHING
  A. The Breathing Process
  B. Causes
    1. Electric shock
    2. Drowning
    3. Suffocation
    4. Poisonous gases
  C. Symtoms
  D. Treatment
    1. Dislodging foreign objects from the throat or windpipe
    2. Artificial respiration
      a. Mouth-to-mouth resuscitation
      b. Mouth-to-nose resusciation
      c. Back-pressure, arm-lift method

V. SEVERE BLEEDING
  A. The Circulatory System

- B. Methods of Control
  - 1. Direct pressure
  - 2. Indirect pressue
  - 3. Positioning the victim
  - 4. Cold packs
  - 5. Tourniquets

VI. BASIC LIFE SUPPORT

- A. Essentials
  - 1. Steps of cariopulmonary resuscitation
    - a. A - Airway obstruction
    - b. B - Breathing (respiratory) arrest
    - c. C - Circulatory, or cardiac (heart) arrest
  - 2. Urgency
    - a. Recognizing need and starting the treatment
    - b. Brain damage
  - 3. Beginning and terminating basic life support
  - 4. Unconsciousness
    - a. Which basic life support needed
    - b. Check for other injuries
- B. Artificial Ventilation
  - 1. Opening airway
    - a. Head-tilt maneuver
    - b. Jaw-thrust maneuver
  - 2. Artificial respiration
    - a. Types
      - 1. Mouth-to-mouth
      - 2. Mouth-to-nose
      - 3. Mouth-to-stoma
    - b. Infants and children
      - 1. Procedure
    - c. Gastric distention
      - 1. Observing and correction
- C. Airway Obstruction
  - 1. Two situations
    - a. The patient may be conscious when discovered but become unconscious
    - b. The patient may be unconscious when discovered
  - 2. Maneuvers to relieve upper-airway obstruction
    - a. Back blows
    - b. Manual thrusts
    - c. Chest thrust
    - d. Combined use of back blows and manual thrusts
    - e. Manual removal of foreign body
  - f. Sequence of maneuvers in attempt to clear airway obstruction
- D. Artificial Circulation
  - 1. Checking circulation
  - 2. External cardiac compression
    - a. Technique of external cardiac compression
    - b. Resuscitation
    - c. Infants and children
    - d. Effectiveness of CPR
    - e. CPR interruption

VII. SHOCK AND FAINTING

- A. Shock

    1. Causes
    2. Symptoms
    3. Treatment
  B. Fainting
    1. Symptoms
    2. Treatment

VIII. OPEN WOUNDS
  A. Dangers
    1. Severe bleeding
    2. Infection
  B. Types and treatment
    1. Abrasions
    2. Incisions
    3. Lacerations
    4. Punctures
    5. Convulsions
  C. Inpaled objects

IX. CLOSED WOUNDS
  A. Types
    1. Bruises
    2. Sprains
    3. Strains
    4. Ruptures or hernias
  B. Symptoms and treatment
    1. Bruises
    2. Sprains
    3. Strains
    4. Ruptures or hernias

X. BURNS AND SCALDS
  A. Types
    1. First degree
    2. Second degree
    3. Third degree
  B. Treatment
  C. Chemical burns
    1. General treatment
    2. Treatment for eyes

XI. FRACTURES AND DISLOCATIONS
  A. Fractures
    1. Definition
    2. Simple and compound
    3. Symptoms
    4. Using a splint
      a. Inflatable
      b. Improvised
    5. Spinal injuries and fractures of the neck, back, and pelvis
  B. Dislocations
    1. Definitions
    2. Symptoms
    3. Treatment

XII. TRANSPORTING THE VICTIM
  A. Pulling and dragging

B. Three-man carry
C. Stretcher
D. Broken back board or orthopedic splint

XIII. SUMMARY

FIRST AID

Introduction:
Personal Injury Accidents
Reasons for First Aid Training
Fundamentals of First Aid
Responding to an Emergency

OBJECTIVES:

1. The sutdent will be able to define first aid.
2. The student will be able to state reasons why men and women will work unsafely or perform unsafe acts even though they know the safe and proper procedures.
3. The student will become aware of the five principal aims of first aid.
4. The student will be able to classify injuries according to the severity of the injury, and arrange the steps for giving first aid in proper sequence.

RESOURCES:

1. MSHA Films - "The First Minute" - "First Things First".
2. Kentucky Mine Safety Training - Cassettes and Slides
   "Introduction to First Aid" 8-1
   "Sequence of Action" - 8-2.
3. Text - Elements of Practical Coal Mining - Pages 475-476.

PRESENTATION AND ACTIVITIES:

1. View cassette and slide presentation.
2. Classroom discussion.
3. View film.
4. Assigned readings.

FIRST AID

The Human Anatomy

OBJECTIVES:

1. The student will be able to name the major bones of the human body in the head, trunk, and extremities.
2. The student will be able to describe the function of the four excretory systems in the human body.

   a) lungs b) kidneys c) intestines and rectum d) skin

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 476-479.
2. Human skeleton.
3. Chart of human anatomy.

PRESENTATION AND ACTIVITIES:

1. Lecture - Use skeleton and chart of human anatomy.
2. Assigned readings.

FIRST AID

Impaired or Stopped Breathing

OBJECTIVES:

1. The students will be able to name the parts of the respiratory system and describe the functions of each:

    a) air passage (nose, throat, and windpipe)
    b) lungs
    c) flexible diaphragm in the chest

2. The students will be able to describe some situations or conditions that could cause breathing to stop.

    a) electric shock b) drowning c) suffocation
    d) poisonous gas

3. The students will be able to recognize symptoms that indicate a person has impaired breathing.

4. Each student will be able to demonstrate three (3) ways of dislodging objects from throat or windpipe.

RESOURCES:

1. MSHA Circular - "First Aid" - Pages 7-11.

2. Kentucky Mine Safety Training Program - Slides and Cassettes- "Respiration" - 8-3 Slides 1, 2, and 3.

PRESENTATION AND ACTIVITIES:

1. Demonstration and lecture - The instructor will use a student volunteer and demonstrate three methods of removing foreign objects from throat or windpipe as he gives his lecture.

2. Students will be grouped in pairs and perform some activity as instructed by teacher.

FIRST AID

Severe Bleeding

OBJECTIVES:

1. The student will become cognizant that knowledge of the circulatory system is of vital importance to the person who is trying to control severe bleeding.

2. The student will be able to describe four methods of controlling bleeding.

   a) direct-indirect pressure b) positioning of the body
   c) cold packs d) tourniquets e) constricting bandages

3. The student will locate major digital pressure points on his own body.

4. The student will be able to describe the symptoms a victim exhibits with injuries causing internal bleeding.

5. The student will be able to state what steps to take in giving first aid to a victim with internal bleeding.

RESOURCES:

1. Charts of the circulatory system.

2. MSHA Circular "First Aid" - Pages 18-23.

3. Kentucky Mine Safety Training Program - Slides and Cassettes.
   "Control of Bleeding" 8-5
   "Pressure Points" 8-6
   "Tourniquets" 8-7
   "Constricting Bandages" 8-8

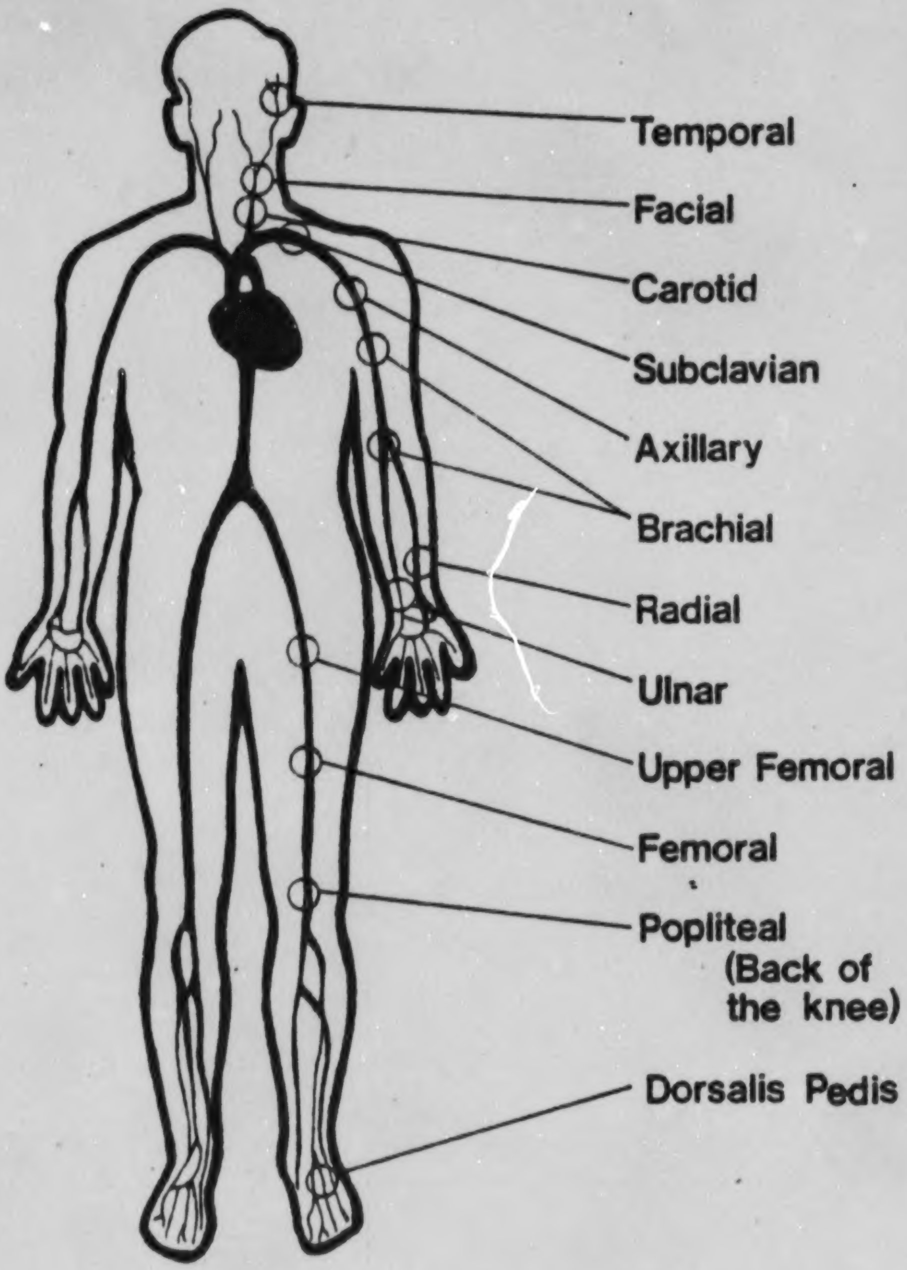
4. MSHA Film - "Control of Bleeding".

PRESENTATION AND ACTIVITIES:

1. With the use of charts, the instructor will teach the circulatory system.

2. Demonstration - methods of control of bleeding.

PRESSURE POINTS


Temporal
Facial
Carotid
Subclavian
Axillary
Brachial
Radial
Ulnar
Upper Femoral
Femoral
Popliteal (Back of the knee)
Dorsalis Pedis

FIRST AID

Artificial Respiration

OBJECTIVES:

1. The student will be able to define artificial respiration.
2. The student will develop a firm mental grasp of two important principles that must be applied upon finding someone whose breathing has stopped.
3. The student will be able to demonstrate a thorough knowledge of clearing the air passages of a victim who is not breathing by choosing a partner and going through the four steps to clear the air passage.
4. The student will become proficient in administering artificial respiration by mouth-to-mouth resuscitation, mouth-to-nose resusciation, and the Holger-Nielson, back pressure, arm lift method.

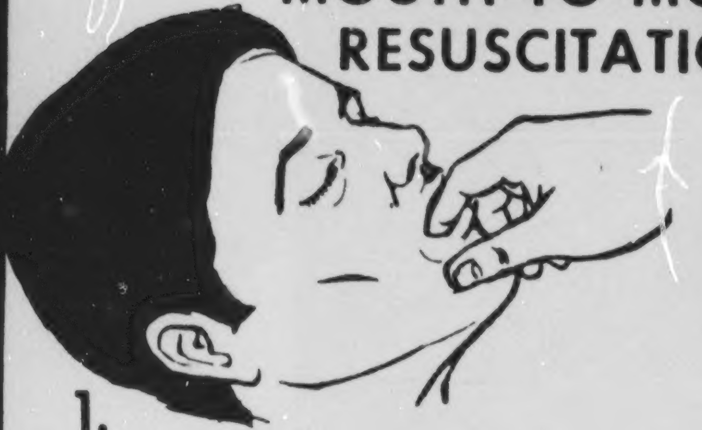
RESOURCES:

1. MSHA Circular - "First Aid" - Pages 12-17.
2. Text - Elements of Practical Coal Mining - Pages 479-486.
3. Kentucky Mine Safety Training Program - Slides and Cassettes.
   "Respiration" 8-3 Visuals V4 - V8.
   "Back Pressure Methods of Artificial Respiration" - 8-4.
4. "Resusci Anne".
5. MSHA Film - "Artificial Respiration".

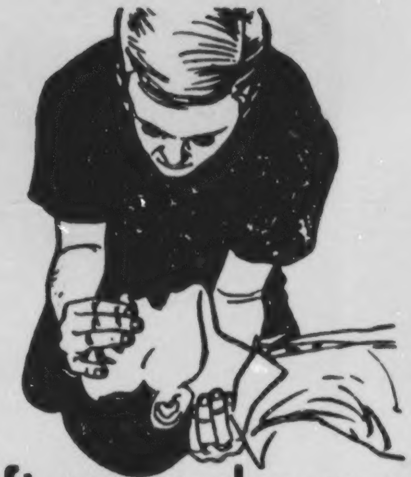
PRESENTATION AND ACTIVITIES:

1. Demonstration - the instructor will demonstrate correct method of clearing the air passage, and then have the students go through the procedures. The instructor will demonstrate artificial respiration with the use of "Resusci Anne" and then have each student go through the procedure.

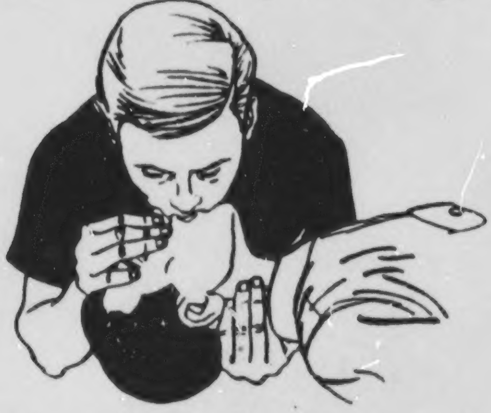
MOUTH-TO-MOUTH RESUSCITATION



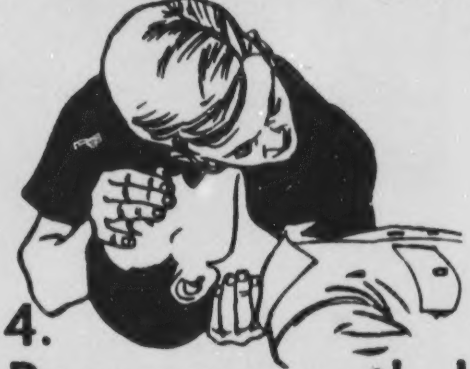
1\.
Clear the air passage.



2. Lift up under neck (extend chin) and pinch the nostrils together.



3\.
Inhale deeply. Breathe into victim's mouth.



4\.
Remove mouth, listen for return flow of air.

FIRST AID

Basic Life Support
Essentials

OBJECTIVES:

1. The student will define basic life support.
2. The student will be able to state the A B C's of cardiopulmonary resuscitation.
3. The student will demonstrate the method of correct positioning of the patient receiving cardiopulmonary resuscitation.
4. The student will describe the circumstances under which CPR is terminated.

RESOURCES:

1. American Academy of Orthopedic Surgeons, Emergency Care and Transportation of the Sick and Injured - Pages 81-86.

PRESENTATION AND ACTIVITIES:

1. Readings.
2. Lecture and discussion.
3. Demonstration by instructor, then by students in correct positioning of the patient.

FIRST AID

Basic Life Support
Artificial Ventilation (Respiration)

OBJECTIVES:

1. The student will be able to describe the steps in beginning artificial ventilation.
2. The student will be able to demonstrate the head-tilt maneuver in removing foreign objects.
3. The student will be able to list the steps and demonstrate the jaw-thrust maneuver.
4. The student will review and demonstrate mouth-to-mouth resuscitation.
5. The student will be able to state reasons why mouth-to-mouth resuscitation is not always the appropriate method.

RESOURCES:

1. American Academy of Orthopedic Surgeons, Emergency Care and Transportation of the Sick and Injured - Pages 86-93.
2. MSHA Film - "Artificial Respiration".
3. "Resusci Anne".

PRESENTATION AND ACTIVITIES:

1. Review of film.
2. Lecture and demonstration.

FIRST AID

Basic Life Support

Artificial Circulation

OBJECTIVES:

1. The student will be able to describe and demonstrate the external cardiac compression technique.

2. The student will be able to describe how artificial respiration is given by two people at the same time.

3. The student will be able to describe the precordial thump technique.

4. The student will be able to recognize differences in techniques when used with children and infants.

RESOURCES:

1. American Academy of Orthopaedic Surgeons, Emergency Care and Transportaion of the Sick and Injured, Pages 94-100

2. "Resusci Anne"

3. M.S.H.A. Film - "Cardiopulmonary Resuscitation (C.P.R.)

4. Blankets

PRESENTATION AND ACTIVITIES

1. Demonstration by instructor and students of cardiac compression as used with adults and as used with children.

2. View film

3. Lecture

4. Discussion

FIRST AID

Basic Life Support
Adjunctive Equipment

OBJECTIVES:

1. The student will be able to list advantages in supplying supplemental oxygen to the patient.
2. The student will describe mouth-to-mask and bag-valve mask breathing techniques.
3. The student will be able to list two types of artificial airways.
4. The student will be able to state the steps used in positioning and using oropharyngeal and nasopharyngeal suctioning devices.

RESOURCES:

1. American Academy of Orthopedic Surgeons, Emergency Care and Transportation of the Sick and Injured, Pages 100-106.
2. "Resusci Anne".
3. Orthopharyngeal and nasopharyngeal suctioning devices.
4. Blankets.

PRESENTATION AND ACTIVITIES:

1. Opaque projector - use of pictures from Emergency Care.
2. Demonstration.
3. Display and demonstration of orapharyngeal and nasopharyngeal suctioning devices borrowed from hospital.

FIRST AID

Physical Shock

Fainting

OBJECTIVES:

1. The student will be able to give several conditions that may cause physical shock.
2. The student will respond to the statement, "The life of all flesh is in the blood."
3. The student will be able to describe the symtoms a person in physical shock exhibits.
4. The student will describe the treatment that should be given to a person in physical shock or one who has fainted.

RESOURCES:

1. Text: Elements of Practical Coal Mining - Pages 492-494
2. M.S.H.A. Circular - "First Aid"
3. M.S.H.A. Film "Physical Shock: The Third Fundamental"
4. Kentucky Mine Saftey Training Program _ Slides and Cassettes
   "Treatment of Shock" 8-10
   "Fainting" 8-11
5. Blankets

PRESENTATION AND ACTIVITIES:

1. View film
2. Opaque projector - pictures from "First Aid"
3. Classroom discussion
4. Demonstration by instructor then by students on how to treat a person in shock or one who has fainted.

FIRST AID

Wounds and Burns

OBJECTIVES:

1. The student will associate the letters P A I L with four types of open wounds: a)puncture b)abrasions c)incisions d)lacerations
2. The student will describe the care for open wounds.
3. The student will be able to correctly bandage at least three types of wounds.
4. The student will be able to describe procedures in the treatment for burns.
5. The student will be able to give examples of closed wounds and state the treatment for each.

RESOURCES:

1. Text: Elements of Practical Coal Mining - Pages 494-497
2. M.S.H.A. Circular -- :First Aid" Pages 25-31
3. Kentucky Mine Safety Training Program - Slides and Cassettes
    "Open Wounds" 8-12
    "Dressing Wounds 8-13
    "Closed Wounds" 8-14
    "Treatment of Closed Wounds" 8-15
    "Burns" 8-18
4. M.S.H.A. Film - "Open and Closed Wounds: The Fourth Fundamental" (Part I)
    "Burns and Scalds: The Fourth Fundamental" (Part II)
5. Bandages - blankets

PRESENTATION AND ACTIVITIES:

1. Practice and demonstration of dressing and bandaging wounds.
2. View film and slides
3. Readings
4. Discussion

FIRST AID

Fractures and Dislocations

OBJECTIVES:

1. The student will be able to explain the symptoms of fractures and dislocations and describe treatment for them.
2. The student will recognize the importance of the spinal cord.
3. The student will demonstrate the use of splints in keeping the injured area immobile.

RESOURCES:

1. MSHA Circular - "First Aid" - Pages 33-38.
2. MSHA Film - "Fractures and Dislocations".
3. Text - Elements of Practical Coal Mining - Pages 497-502.
4. Kentucky Mine Safety Training Program - Slides and cassettes.
   "Fractures and Dislocations" 8-19.
   "Treatment For Fractures and Dislocations" 8-20.
5. Blankets.
6. Bandages.
7. Splints.

PRESENTATION AND ACTIVITIES:

1. View film - slides.
2. Readings.
3. Demonstration - bandaging with splints, various types of fractures and dislocations.

FIRST AID

Transporting the Victim

OBJECTIVES:

1. The student will be able to describe and demonstrate the proper way to transport a victim.

RESOURCES:

1. M.S.H.A. Circular "First Aid" Pages 38-41
2. M.S.H.A. Film "Transportaion"
3. Kentucky Mine Safety Training Program - Slides and Cassettes "Transporting the Injured" 8-21
4. Blankets
5. Bandages
6. Strechers
7. Text - Elements of Practical Coal Mining - Pages 502-503

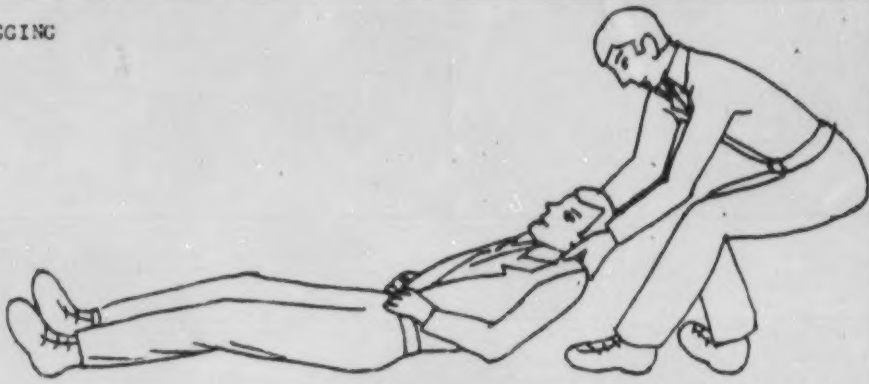
PRESENTATION AND ACTIVITIES:

1. View film and slides
2. Classroom discussion
3. Demonstration - students will practice transporting a victim.

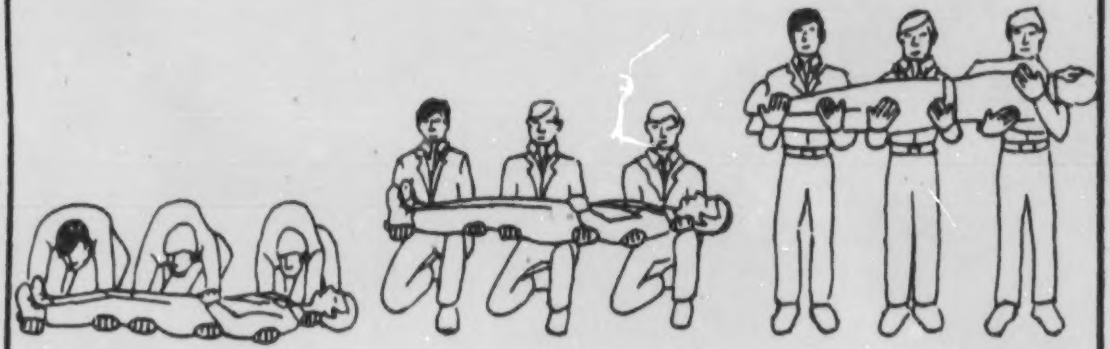
Transporting the Victim

PULLING OR DRAGGING

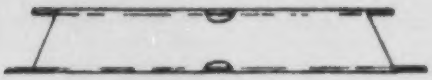
THE VICTIM



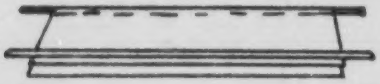
THREE MAN CARRY



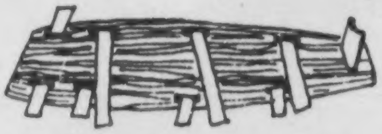
TYPES OF STRETCHERS



Army Stretcher



Improvised Blanket Stretcher



Stretcher Board

FIRST AID

Location of First Aid Equipment

Review

OBJECTIVES:

1. The student will know the location of first aid materials and equipment in the mines.
2. The student will be able to state the sequence of steps in First Aid.

RESOURCES:

1. Kentucky Mine Safety Training Program - Slides and Cassettes "Location of First Aid Equipment"

PRESENTATION AND ACTIVITIES:

1. View Slides
2. Oral and written review of First Aid

GLOSSARY OF TERMS (First Aid)

1. Air passage - Any of several tubes and passages which transmit air from the nose or mouth to the fine bronchioles of the lung. An airway.

2. Air splint - A double-walled plastic tube in which a limb can be immoblized when air is blown into the space between the walls. When the tube is sufficiently inflated, it will form a rigid splint. Inflation should always be by mouth.

3. Airway - Anatomic passage for the transport of air into and out of the lungs.
   lower airway - The passage from the epiglottis to the pulmonary alveoli, including the larynx, trachea, bronchi and bronchioles.
   upper airway - The passage from the nose, mouth, oropharynx, and nasopharynx to the epiglottis.

4. Airway, artificial - A device to provide and maintain free passage of air through the upper airway.

5. Aorta - The main arterial trunk arising at the heart from which the arterial system proceeds.

6. Artery - One of the tubular vessels which carries oxygenated blood from the heart to the tissues of the body.

7. Bag-value-mask - A portable artificial ventilation unit consisting of a facemask, a valve, and an unflatable bag.

8. Blood - The circulating tissue of the body; the fluid and its suspended, formed elements that are circulated through the heart, arteries, veins, and capillaries. Blood is the means by which (1) oxygen and nutritive materials are transported to sustain life, and (2) carbon dioxide and various metabolic products are removed for excretion to cleanse the body.

9. Blood pressure - The pressure of the blood on the walls of the arteries, determined by the energy of the heart action, the elasticity of the walls of the arteries, and the volume and viscosity of the blood.

10. Blood volume - The total quanity of blood in the body.

11. Burn - A lesion caused by heat or any cauterizing agent.

12. Cardiac - Pertaining to the heart. Sometimes refers to a person who has heart disease, meaning a cardiac patient.

13. Cariac arrest - A sudden cessation of effective cardiac function, with disappearance of arterial blood pressure.

14. Cardiac compression - External heart massage to restore circulation and the pumping action of the heart by artificial means.

15. Cardiogenic shock - Shock resulting from decreased cardiac output as a result of primary heart disease; seen in myocardial infarction.

16. Circulatory - Pertaining to the heart, blood vessels, and the circulation of the blood.

17. Coma - A state of unconsciousness from which the patient cannot be aroused, even by powerful stimulation.

18. Closed fracture - A fracture in which there is no communication between the broken bone and the outside environment through the overlying skin.

19. Comminuted fracture - A fracture in which the bone ends are broken into many fragments.

20. Compound fracture - Open fracture; one in which there is an open wound of the skin and soft parts leading down to the seat of the fracture.

21. Contusion - The reaction of body soft tissue to a direst blow. A bruise characterized by edema and ecchymasis of the tissue.

22. Cyanosis - A bluish or purplish discoloration of the skin due to a lack of oxygen in the blood.

23. Defribrillator - Any agent or measure, such as an electric shock, used to stop an incoordinated contraction of the heart muscle and restore a normal heartbeat.

24. Diaphragm - A flat, circular sheet of muscle separating the thoracic and abdominal cavaties.

25. Dislocation - The displacement of the ends of two bones at their joint so that the joint surfaces are no longer in proper contact.

26. Dressing - Sterile gauze or compresses of various sizes applied for protection of a wond and fixed in position; a bandage.

27. Ecchymosis - A discoloration of the skin resulting from subcutaneous (skin) and intracutaneous hemorrhage. Bluish in color at first, later it changes to a yellowish green because of chemical changes in the pooled blood.

28. Expiration - The act of breathing out or expelling air from the lungs.

29. Faint - A temporary loss of consciousness, usually brief duration and not serious.

30. Four-man log roll (the back injury roll) - A method of placing a patient on a carrying device, usually a long spineboard or a flat litter by rolling him on his side, then back onto a litter.

31. Fracture - Any break in a bone. In a fracture the bones may be separated into several pieces, clearly broken, or only cracked and bent.

32. Head tilt maneuver - Procedure for opening the airway to relieve obstruction caused by the tongue.

33. Immobilize - To make incapable of moving.

34. Jaw thrust maneuver - Procedure for opening the airway.

35. Ladder splint - A flexible splint consisting of two stout parallel wires and cross wires. It resembles a ladder.

36. Obstruction - A block or clogging.

37. Open fracture - A fracture or dislocation having a direct communication with the outside through the skin. There may be a small wound over the fracture or dislocation, or the ends of the bone may be protruding through the skin.

38. Open wound - One in which the affected tissues are exposed by an external opening.

39. Oxygen - A gaseous element existing free in the air. It is absolutely required to support life processes.

40. Pressure point - One of several places on the body where the blood flow of a given artery can be restricted by pressing it against an underlying bone.

41. Pressure splints - Inflatable plastic circumferential splints that may be applied to an extremity and inflated to achieve stability after a fracture.

42. Prone - The position of the body when lying face downward.

43. Puncture wound - The penetration of the skin with a sharp or pointed object.

44. Respiratory system - A system of organs, the function of which is to control the drawing-in and breathing-out of oxygen and carbon dioxide, respectively.

45. Resuscitation - The techniques of using assisted breathing to restore adequate ventilation and external cardiac massage to support circulation.

46. Shock - A generalized depression of all body functions caused by progressive failure of the cardiovascular system so that perfusion of tissues and organs is lost.

47. Spineboard - A wooden or metal device primarily used for extrication and transportation of patients with actual or suspected spinal injuries; also serves as a litter and can be used to raise or lower patients or to provide rigid support during cardiac compression.

48. Splint - A device to immobilize an injured part.
traction splints: are those that immobilize by applying pull to the injured part.
rigid splints: are thse that immobilize by applying a rigid structure to the injured part.

49. Stretcher - A device used to transport patients to, from, and in an ambulance, usually wheeled but also portable.

50. Ventilation - The process of breathing: the constant supplying of oxygen to the body through the lungs and concurrent removal of carbon dioxide.

PREPARATION, SAMPLING, AND ANALYSIS OF COAL

I. INTRODUCTION

II. ECONOMICS OF COAL PREPARATION
  - A. Summary of the Preparation Process

III. FACE PREPARATION
  - A. Elimination of removable impurities
  - B. Inferior Coal
  - C. Foreign Material
  - D. Control of Size Consist
    - 1. Mining systems
      - a. Conventional
      - b. Continuous mining
  - E. Control of Moisture
    - 1. Factors determining moisture content
      - a. Inherent or natural moisture
      - b. Effectiveness of mine drainage systems
      - c. Natural mine drainage as affected by mining plans
      - d. Applying water at face or during underground transportation

IV. RAW COAL HANDLING
  - A. Raw Coal Storage and Blending
  - B. Hand Picking

V. CRUSHING
  - A. Selection of Proper Types of Crushing Facilities
  - B. Types of Crushers
    - 1. Roll-type
    - 2. Hammermill type
    - 3. Jaw crusher
    - 4. Slugger crusher
    - 5. Rotary breakers

VI. SCREENING
  - A. Historically
    - 1. Types of Screens
      - a. Marcus
      - b. Jouncer
      - c. Parrish
  - B. Vibrating Screens
    - 1. Slope of screen
    - 2. Thickness of the bed
    - 3. Statification of particles
    - 4. Screening media

VII. COURSE COAL WASHERS
  - A. Hydroseparator
  - B. Rheolaveur
  - C. Baum Jigs
    - 1. Depth of refuse bed
    - 2. Versatility

- VIII. HEAVY MEDIA WASHERS
  - A. Neldco unit
  - B. DMS vessel
  - C. Teska vessel
  - D. Process of heavy media cleaning
- IX. FINE COAL CLEANING
  - A. Selection of the type of equipment
  - B. Types of cleaning
    - 1. Air-cleaning
    - 2. Wet-type units
      - a. Launders
      - b. Duster tables
      - c. Feldspar jig
      - d. Heavy media cyclones
      - e. Hydrocyclones
- X. FROTH FLOTATION
  - A. Define coal flotation
  - B. Factors affecting coal flotation
  - C. Froth cells
- XI. DEWATERING AND DRYING
  - A. Types of screens
    - 1. Vibrating screens and centrifugal dryers
    - 2. Sieve bend screens
    - 3. Classifying cyclones
    - 4. Static thickness
    - 5. Centrifugal
  - B. Thermal dryers
    - 1. Process
    - 2. Types of dryers
    - 3. Use of dryers
- XII. SAMPLING AND ANALYSIS OF COAL
  - A. Introduction
  - B. Theory of sampling
    - 1. Increments of lot or shipment
    - 2. Reliability
      - a. Precise
      - b. Accurate
    - 3. Errors
      - a. Change
      - b. Systematic
  - C. Types of sampling
    - 1. Mechanical
      - a. Reducing of sample
    - 2. Manual sampling
      - a. Reducing of sample
  - D. Approach to exploration
    - 1. Preliminary investigation
    - 2. Draft exploration program
    - 3. Evaluation of exploration samples
    - 4. Assessment of data
    - 5. Quality of reserves
    - 6. Large-scale sampling and evaluation prior to development

E. Laboratory test
  1. Proximate analysis
    a. Water (moisture)
    b. Mineral impurity
    c. Volatile matter
    d. Fixed carbon
  2. Ultimate analysis
    a. Determination of carbon and hydrogen
    b. Determination of sulfur, nitrogen, and ash
    c. The estimation of oxygen by deference
  3. Calorific analysis
  4. Hargrove gridibility index
  5. Coal ash fusibility
  6. Ash composition
  7. Tree-swelling index
  8. Size-consist

PREPARATION, SAMPLING AND ANALYSIS

Economics of Coal Preparation
Face Preparation

OBJECTIVES:

1. The student will be able to summarize the coal preparation process.
2. The student will describe how mechanization improved coal production but increased the amount of impurities.
3. The student will be able to identify mineral impurities that are found in coal.
4. The student will be able to state factors that determine the moisture content of coal.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Page 425.

PRESENTATION AND ACTIVITIES:

1. Assigned readings.
2. Lecture.

PREPARATION, SAMPLING AND ANALYSIS

Raw Coal Handling
Crushing

OBJECTIVES:

1. The student will be able to state the advantages of raw coal storage in bins or piles at the coal preparation site.
2. The student will be able to state the advantages and disadvantages of hand picking the impurities from the mined coal.
3. The student will identify factors that should be considered in the selection of the proper type of crushing facilities.
4. The student will be able to name five types of crushers and explain the operation of each.

   a) roll-type b) hammermill c) jaw d) slugger
   e) rotary

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 428-431.

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Assigned readings.

PREPARATION, SAMPLING AND ANALYSIS

Screening

OBJECTIVES:

1. The student will be able to describe, briefly, three types of screens that have been used in the past.

   a) Marcus b) Jouncer c) Parrish

2. The student will be able to describe the operation of vibrating screens.

3. The student will be able to determine the differences in the use of vibrating screens in today's modern preparation plants and those that were used in the past.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 431-433.

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Assigned readings.

PREPARATION, SAMPLING AND ANALYSIS

Coarse Coal Washers
Heavy Media Washers

OBJECTIVES:

1. The student will be able to determine the functions of coal washers.
2. The student will be able to determine different types of coal washers and describe their operation.

   a) hydroseparator b) rheolaveur c) baum jigs

3. The student will be able to name four types of heavy media washers.

   a) Neldco b) D.M.S. vessel c) Teska

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 436-440.

PRESENTATION AND ACTIVITIES:

L. Lecture - opague projector - pictures and descriptions of each type of washer given in the text.

PREPARATION, SAMPLING AND ANALYSIS

Fine Coal Cleaning
Froth Flotation
Dewatering and Drying

OBJECTIVES:

1. The student will be able to describe the factors that must be considered in the selection of the type of equipment to be used in cleaning fine coal.
2. The student will be able to state the advantages and disadvantages of air cleaning units and wet cleaning units.
3. The student will be able to define "froth flotation".
4. The student will be able to describe processes used in removing excess water from the coal.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 444-451.

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Assigned readings.

PREPARATION, SAMPLING AND ANALYSIS

Sampling and Analysis

OBJECTIVES:

1. The student will be able to recognize the importance, economically, a continuous analysis of coal is to the mining company.
2. The student will be able to state underlying principles common to all sampling experiments.
3. The student will be able to state two types of sampling and describe how each is done.

   a) mechanical b) manual

4. The student will be able to describe two methods of coal analysis and what is included in each analysis.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 451-453.

PRESENTATION AND ACTIVITIES:

1. Assigned readings.
2. Lecture.

PREPARATION, SAMPLING, AND ANALYSIS

Field Trip

OBJECTIVES:

1. The student will be able to relate information studied in this unit to the actual workings and activities of a modern coal preparation plant by on-site visitation.
2. The student will be able to identify processes used in coal analysis by on-site visitation to a coal analysis laboratory.
3. The student will interview personnel at the coal preparation plant and at the coal analysis laboratory as to their job responsibilities and requirements for employment in the various types of positions.

RESOURCES:

1. Coal preparation plant - coal analysis laboratory, Benham, Kentucky.

PRESENTATION AND ACTIVITIES:

1. Preparation for field trip.
    a) Interviewing technique - questions that may be asked.
    b) Specific points to look for: screening the coal, crushing, type of washers, drying methods, pollution control, and types of tests used to determine coal content.
2. Field trip.

GLOSSARY OF TERMS (Preparation, Sampling and Analysis)

Chemical or proximate analysis. Tests made on coal to determine moisture, volatile matter, fixed carbon and ash, calorific value and sulpher content.

Dewatering. A method used to reduce, either by mechanical or thermal means, the surface moisture in coal before shipping.

Friability. The ability of coal to withstand breakage in handling and shipping.

Froth flotation. A chemical process that depends on the selective adhesion to air of solids (coal) and the simutaneous adhesion to water of other solids (refuse), or in simple terms, surface separation.

Grindability. The physical property of coal which determines the relative ease of pulverizing or grinding a coal.

Increments. Small portions of coal taken from selected points over the entire shipment or lot of coal. (samples)

Raw coal. Coal as it comes from the mine, without cleaning or separation as to size.

Sampler. A person, or a mechanical operation, that collects samples, or increments of coal for analysis.

Size. Sized coal is the result of separating mixed particles into groups of particles with the same approximate size, or into groups in which the range of particles is between definite maximum and minimum sizes.

SURVEYING AND MAPPING

- I. INTRODUCTION

- II. SURVEYING METHODS
  - A. Types of Surveying
    - 1. Land
    - 2. Route
    - 3. City
    - 4. Mining
  - B. General Classifications of Surveying Methods
    - 1. Plane
    - 2. Geodetic
  - C. Purpose of Surveying Methods
    - 1. Direction
    - 2. Distance
    - 3. Elevation
  - D. Surveying Principles
    - 1. Horizontal distance
    - 2. Direction of a straight line
  - E. Direction Measurement
    - 1. Determining the direction of an unknown line
  - F. Concept of Direction
    - 1. Position of points on a 360° circle

- III. BEARINGS AND AZIMUTHS
  - A. The Relationship of Azimuth Circle to the Great Circle
  - B. The Relationship of the Bearing Circle to the Great Circle
  - C. Converting Azimuths to Bearings

- IV. MEASURING ANGLES
  - A. Setting Up An Engineers Transit
    - 1. Horizontal angle, right
    - 2. Horizontal angle, left
  - B. Deflection angle, right
  - C. Deflection angle, left

- V. SURVEYING INSTRUMENTS
  - A. The Engineers Transit
    - 1. Parts
    - 2. Measuring and angle
  - B. Distance Measurement
    - 1. Horizontal distance
      - a. Using the steel tape
    - 2. Slope distance
      - a. Using the steel tape
  - C. Leveling
    - 1. Direct method
      - a. Instruments
      - b. Technique
        - 1. Method of recording levels

VI. MINING SURVEYING
  A. Introduction
    1. Lighting
    2. Upside-down technique
  B. Systematic layout
    1. Passageways
      a. Main sets
      b. Secondary sets
  C. Scope of work
    1. Two principal purposes for underground surveying
      a. Locations according to design
        1. Station points (spads)
        2. Locations for turning mine openings
        3. Centerline for mine openings
      b. Measurement of progress

VII. MINE MAPS
  A. Categories of maps
    1. Surface
    2. Underground
  B. Scale of mine maps
    1. Different distance scales
    2. Plotting of mine maps
      a. Coordinate system
      b. Procedure

VIII. KEEPING ON CENTERS
  A. Introduction
    1. Centerline projections
  B. Turning a place without a transit
    1. Procedure
  C. Turning angles other than 90 degrees
    1. 45-degree angle
      a. Procedure
    2. 60-degree angle
      a. Procedure
    3. 30-degree angle
      a. Procedure
  D. Sighting in centers
    1. Procedure

SURVEYING AND MAPPING

Surveying Methods

OBJECTIVES:

1. The student will be able to recognize the relationship between surveying and mapping.
2. Given four types of surveying methods the student will match the method with the correct purpose of each.
3. The student will be able to classify two types of surveying.

   a) plane   b) geodetic

4. The student will be able to define "leveling".
5. The student will be able to state in simplified terms, the general principles of surveying methods.
6. The student will be able to explain why the compass is not used at the present time as much as it was in the past.
7. The student will be able to calculate the distance of an unknown line using the 360° circle.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 541-544.

PRESENTATION AND ACTIVITIES:

1. Lecture (chalkboard).
2. Assigned readings.

SURVEYING AND MAPPING

Bearings and Azimuths

OBJECTIVES:

1. The student will be able to state the relationship of the bearing and azimuths circles to the Great Circle.
2. The student will be able to convert azimuths to bearings.
3. The student will interview a surveyor.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 544-546.

PRESENTATION AND ACTIVITIES:

1. Lecture (chalkboard).
2. Resource person - Instructor at Southeast Community College, also a surveyor, will bring his instruments and demonstrate how they are used.

SURVEYING AND MAPPING

Measuring Angles
Surveying Instruments

OBJECTIVES:

1. The student will describe how the engineers transit is used to measure angles.

    a) horizonal angle, right-left
    b) deflection angle, right-left

2. The student will name three types of surveying instruments and state how each one is used.

    a) engineer's transit b) theodilite c) level

3. The student will be able to describe the technique used in finding the relative elevation of a point.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 546-556.

PRESENTATION AND ACTIVITIES:

1. Lecture (chalkboard and overhead projector).
2. Assigned readings.

SURVEYING AND MAPPING

Mining Surveying

OBJECTIVES:

1. The student will be able to state the difference in underground surveying methods from that of surface surveying methods.

   a) lighting b) upside-down technique

2. The student will be able to see a relationship between the systematic layout of a city and that of an underground mine.
3. The student will be able to determine the importance of keeping an accurate mine map current and up-to-date.
4. The student will interview a surveyor employed by Eastover Mining Company.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 556-558.
2. Resource person.

PRESENTATION AND ACTIVITIES:

1. Resource person.
2. Lecture.
3. Assigned readings.

SURVEYING AND MAPPING

Mine Maps
Keeping on Centers

OBJECTIVES:

1. The student will be able to identify two types of mine maps and the information that would be found on each.

   a) surface maps   b) underground map

2. The student will be able to measure distances on a map by using scale.

   a) 1 in. = 100 ft. or b) 1 in. = 500 ft.

3. Given an example of a mine map, the student will describe the methods used in plotting the map from surveying information.

4. The student will be able to describe what spad stations are and how they are used in measuring in an underground.

5. The student will be able to describe how a mine foreman may measure an angle and turn a place without a transit.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 558-567.

2. Chalk - string.

PRESENTATION AND ACTIVITIES:

1. Demonstration.

2. Lecture.

3. Illustration of a mine map.

SURVEYING AND MAPPING

Field Trip

OBJECTIVES:

1. The student will be able to investigate how a mine map is drawn from the survey information.
2. The student will tour the engineering department of an underground mining operation.

RESOURCES:

1. Eastover Mining Company - Highsplint, Kentucky.

PRESENTATION AND ACTIVITIES:

1. Review of surveying and mapping.
2. Field trip.

GLOSSARY OF TERMS (Surveying and Mapping)

Elevation. The elevation of a point is its vertical distance above or below a given reference level surface. The difference in elevation between two points is the vertical distance between two level surfaces containing the two points.

Geodetic surveying. That branch of surveying wherein all distances and horizonal angles are projected onto the surface of the spheriod that represents mean sea level on the earth.

Horizonal angle. An angle measured in a horizonal between two vertical planes. In surveying this definition is effective only at the point at which the measurement is made or at any point vertically above or below it.

Horizonal distance. A horizonal distance between two given points is the distance between the points projected on a horizonal plane.

Horizonal line. A horizonal line at a point is any line that is perpendicular to the vertical line at the point. At any point there are an unlimited number of horizonal lines.

Horizonal plane. A horizonal plane at a point is the plane that is perpendicular to the vertical line at the point. There is only one horizonal plane through a given point.

Level surface. A level surface is a continuous surface that is at all points perpendicular to the direction of gravity. It is exemplified by a large body of water at complete rest.

Plane surveying. That branch of surveying wherein all distances and horizonal angles are assumed to be projected onto one horizonal plane.

Vertical angle. An angle measured in a vertical plane. By convention, if the angle is measured upward from a horizonal line or plane, it is referred to as a plus or positive vertical angle, and also as an elevation angle. If the angle is measured downward, it is referred to as a minus or negative vertical angle, and also as a depression angle.

Vertical line. A vertical line at any point on the earth's surface is the line that follows the direction of gravity at that point. It is the direction which a string will assume if a weight is attached to the string and the string is suspended freely at the point. At any given point there is only one vertical line.

Vertical plane. A vertical plane at a point is any plane that contains the vertical line at the point. There are an unlimited number of vertical planes at a given point.

ENVIRONMENT - LAND, WATER, AND AIR

Land

- I. INTRODUCTION
- II. ACTIVE SURFACE MINING OPERATIONS
  - A. Open Pit Mining
    - 1. Description
    - 2. Surface conditions
      - a. Favorable
      - b. Unfavorable
  - B. Area Mining
    - 1. Description
    - 2. Problems
    - 3. Multiple land use
  - C. Contour Mining
    - 1. Description
    - 2. Problems
    - 3. Land restoration
  - D. Augering
    - 1. Recovery
  - E. Future use of the land
- III. DISPOSAL OF MINERAL WASTES
  - A. Disposal Problems
    - 1. Past problems and practices
  - B. Present and Future Disposal of Mineral Wastes
    - 1. Factors that need to be considered for disposal areas for the life of a mine
      - a. Proper drainage control
      - b. Construction of disposal area
      - c. Use of course refuse
      - d. Covering gob piles
  - C. Disposal of slurry
    - 1. Pit method
    - 2. Slurry ponds
      - 1. Space
      - 2. Construction
      - 3. Vegetation as cover for abandoned slurry ponds
- IV. TRASH DISPOSAL
  - A. Proper Disposal of Mine Trash
  - B. Proper Beautification and Return of Usefulness of Abandoned Structures
  - C. Proper Closing of Abandoned Mine Openings
- V. FINAL DISPOSITION OF MINING AREAS
  - A. Land Reclamation
    - 1. Reasons for reclamation
    - 2. Reclamation problems
      - a. Midwest region
      - b. Appalachian region
      - c. Desert or low rainfall regions

B. Cover Crops
  1. Factors to be considered
    a. Site preparation
      1. Stablizing soi
      2. Correcting PH and mineral deficiences
    b. Planting time
      1. Depends on area
    c. Planting method
      1. Aerial
      2. Hand-broadcasting
      3. Use of farm machinery
      4. Hydroseeding
    d. Seed or seed mixture
      1. Certain guidelines to follow
        a. At least one species in the mixture should be able to germinate rapidly and prevent erosion
        b. The ultimate stand of vegetation should provide a relatively solid cover for long-term stability
        c. It should contain some long-lived perennials
        d. Select those species which are adapted to the mining area

VI. ACTIVE MINING PLANTS
  A. Should be clean
  B. Blend in the surrounding area
  C. Structures are maintained in a safe way

WATER

I. INTRODUCTION
  A. Importance of water
  B. The use of water in mining
  C. Past and present discharging of water from mines

II. FORMATION OF MINE DRAINAGE
  A. Types of water discharged from mines
    1. Neutral or pure water
      a. Used for lakes and ponds
      b. Simple treatment for drinking water
    2. Acid water
      a. Acid water
        1. Formation
          a. Underground
          b. Surface
          c. Treatment
    3. Alkaline water
      a. Formation
      b. Treatment

III. CONTROLLING MINE DRAINAGE POLLUTION
  A. Preventing the formation of mine drainage or removing the pollutants by chemical treatment
    1. Drainage control

    - a. Quick removal of mine water
    - b. Collection of water from surface mine area and prevention of water from entering mining area
    - c. Sealing of cracks and crevices to prevent entrance of water
- B. Treatment of mine drainage
  - 1. Physical treatment
    - a. Settling ponds
      - 1. Construction and application
  - 2. Chemical treatment
    - a. Suspended solids and acid water
      - 1. Limestone treatment
      - 2. Settling ponds
    - b. Dissolved iron with alkaline water
      - 1. Aeration
      - 2. Settling ponds
    - c. Dissolved iron with acidic water
      - 1. Hydrated lime treatment
      - 2. Aeration
      - 3. Settling ponds
    - d. Problems associated with chemical treatment
      - 1. Sludge disposal
      - 2. Maintenance problems
      - 3. Costs
- C. Mine Sealing and Flooding
  - 1. Elimination of Air From Mine
    - a. Sealing of mine openings
    - b. Injecting inert gases
    - c. Sealing of surface cracks
    - d. Problems of keeping air and water from escaping or draining out of a confined area
    - e. Flooding a mine to eliminate acid formation
      - 1. Use of water for drinking
- D. Research
  - 1. The role of bacteria
  - 2. Chemical treatment
  - 3. Treatment processes for drinking water
  - 4. Rehabilitation of entire watersheds

AIR

- I. INTRODUCTION

- II. AIR POLLUTION AROUND MINES
  - A. Fugitive Dust
    - 1. Examples of laws
    - 2. Examples of prevention
      - a. Use water or oil on roads
      - b. Use of water around discharge and breaker facilities for coal
      - c. Use of wetting agents
      - d. Enclosing transfer points
  - B. Open Burning
    - 1. Examples of laws
    - 2. Permits

- a. Land clearance
- b. Trash burning
  - 1. Incinerator
  - 2. Burying

III. COAL PREPARATION PLANTS
- A. Control of Air Pollution Around:
  - 1. Thermal dryers
  - 2. Air cleaning tables
  - 3. Loading facilities

ENVIRONMENT - LAND, WATER, AND AIR

Land
Active Surface Mining Operations

OBJECTIVES:

1. The student will be able to classify surface mining operations into four broad categories.

   a) Open pit b) Area c) Contour d) Auger

2. The student will be able to describe the four types of mining operations and state the restoration problems and restoration efforts connected with each.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 510-513 and 386-394.

PRESENTATION AND ACTIVITIES:

1. Lecture
2. Review "Modern Mining Methods - Surface".
3. Discuss field trip to surface mine and efforts being made to restore the land.

ENVIRONMENT - LAND, WATER, AND AIR

Land
Disposal of Mineral Wastes
Trash Disposal

OBJECTIVES:

1. The student will be able to describe problems associated with waste disposal.
2. The student will be able to identify various solutions to the problems the mining industry has implemented.
3. The student will be able to describe the methods used in the disposal of slurry.

   a) pit b) ponds c) revegetation
4. The student will be able to identify potential hazards of abandoned coal mines without proper sealing.
5. The student will investigate his/her home and school vicinity to determine old mine sites and efforts that have been made to dispose of trash and removal of tipples, tracks, and conveyor structures no longer in use.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 517-518.

PRESENTATION AND ACTIVITES:

1. Field research.
2. Lecture.
3. Assigned readings.

ENVIRONMENT - LAND, WATER, AND AIR

Land
Final Disposition of Mining Areas

Active Mining Plants

OBJECTIVES:

1. The student will identify reclamation problems peculiar to different regions of the country.

   a) midwest b) appalachian c) desert, low rainfall

2. The student will identify factors to be considered in the selection of cover corops to be planted.

   a) site preparation
   b) planting time
   c) planting method
   d) seed - seed mixture
   e) long term stability

3. The students will be able to describe how an active mining plant could beautify its property.

RESOURCES:

1. Text - Elements of Practical Coal Minging - Pages 518-522

PRESENTATION AND ACTIVITIES:

1. Each student will select one type of surface mining operation. Follow through each step by describing how he/she would do the following:

   a. type of mining operation
   b. disposal of mineral wastes
   c. disposal of slurry and other trash
   d. unused property-miner's houses, old tipples, etc.
   e. reclamation procedures

ENVIRONMENT - LAND, WATER, AND AIR

Water
Importance - Mine Drainage
Controlling Mine Drainage Pollution

OBJECTIVES:

1. The student will be able to recognize a change in attitude by the general public regarding water as shown by increased environmental standards and federal laws relating to clean water.

2. The student will be able to name three types of water discharged from the mines and how each can be treated.

   a) neutral b) acid c) alkaline

3. The student will be able to categorize efforts being made today to control mine drainage into four broad categories:

   a) drainage control b) treatment of mine drainage
   c) mine sealing and flooding d) research

4. The student will study current controversy in Eastern Kentucky relating to strip mining and recent flooding in the area.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 526-533.

2. Encyclopedias, magazines.

PRESENTATION AND ACTIVITIES:

1. Lecture.

2. Review unit on "Drainage".

3. Library - reference materials.

4. Assigned readings.

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ENVIRONMENT - LAND, WATER, AND AIR

Air
Air Pollution Around Mines
Coal Preparation Plants

OBJECTIVES:

1. The student will become familiar with examples of the laws controlling "fugitive dust".
2. The student will be able to state methods used to prevent dust from accumulating.
3. The student will become familiar with the laws governing open burning of materials within his/her district.
4. The student will be able to state two ways the mining industry disposes of trash.

   a) incinerator burning   b) burial
5. The student will be able to identify ways a coal preparation plant controlls pollution around thermal dryers, air cleaning tables, and loading facilities.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 534-540.

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Assigned readings.
3. Review of field trip to coal preparation plant.

GLOSSARY OF TERMS (Environment, Land, Water, and Air)

Disposal. Any method used to rid the mines of unwanted waste material.

Drainage. A system of drains, artificial or natural, used to withdraw water.

Erosion. The process by which the surface of the earth is worn away.

Fugitive dust. The dust formed from normal processing operations.

Open-pit mining. A mining operation which generally employs large scraper-loaders to remove the overburden, resulting in huge, open excavations.

Reclaim. The act of bringing land into a condition for cultivation or other use.

Red dog. Rufuse which has been stock piled and ignites itself by spontaneous combustion and burns over a long period or time, produces a material called "red dog". This material is highly favored for roads, parking lots, and general surfacing.

Restoration. The bringing back to a former, original, normal, or unimpaired condition.

Soil. A very thin outer layer forming the top of the earth's crust, varying in thickness from a few inches to a few feet, that covers the rocks and minerals lying beneath its surface; that part of the earth's surface in which plants grow.

Vegetation. The type of plant growth.

Yellowboy. The reaction of ferrous sulphate with air and water. This substance imparts the yellow-orange color to rivers and streams polluted by acid mine drainage. The sulphuric acid formed by this reaction prevents fish and aquatic life from living in the region.

LABOR RELATIONS

- I. FEDERAL MINE SAFETY AND HEALTH ACT OF 1977 AND TITLE 30 OF THE CODE OF FEDERAL REGULATIONS
  - A. Purpose
    - 1. Safety and Health Act - to protect the safety and health of mines
    - 2. 30 CFR - to handle specific legal and regulating situations
  - B. Differences Between the Two Documents
    - 1. Safety and Health Act sets general mine safety guidelines
    - 2. 30 CFR sets specific rules and regulations

- II. CHAIN OF COMMAND
  - A. Varies with each mine
  - B. Usually begins with a section foreman and goes on up to the shift foreman, mine foreman, and superintendent

- III. THE ROLE OF THE COAL MINING COMPANY
  - A. Superintendent
    - 1. Duties
    - 2. Responsibilities
    - 3. Rights
  - B. General Mine Foreman
    - 1. Duties
    - 2. Responsibilities
    - 3. Rights
  - C. Shift Foreman
    - 1. Duties
    - 2. Responsibilities
    - 3. Rights
  - D. Section Foreman
    - 1. Duties
    - 2. Responsibilities
    - 3. Rights
  - E. Company Health and Safety Rules
    - 1. Each company has their own rules for individual mines
    - 2. Company rules handle specific situations for each mine
  - F. Mine Official Responsible for Health and Safety
    - 1. Safety director or safety officer
    - 2. Supervises health and safety practices for a mine

- IV. THE ROLE OF THE UNION
  - A. Different unions
    - 1. U.M.W.A.
    - 2. Southern Labor Union
  - B. Unions
    - 1. Representatives of miners wants and needs
      - a. Problems that may arise
      - b. Bargaining for workers with company for workers contract
        - 1. Retirement benefits

    - 2. Health benefits
    - 3. Wages
    - 4. Fringe benefits
  - c. The role of unions throughout coal mining history in the U.S.
  - d. Miner representatives
    - 1. Chosen by miner
    - 2. Must file with MSHA

V. THE ROLE OF THE INDIVIDUAL MINER

- A. Responsibilities of the Miner
  - 1. Rules and regulations of the mining company
    - a. To obey lawful rules of the mining company
    - b. Absenteeism
    - c. Quality and quantity of work
    - e. Obeying lawful requests from mining officials
    - f. Suggesting improvement in safety and production of company
- B. Reporting Accidents and Hazards
  - 1. Follow the chain of command
  - 2. Report hazard or accident to miner representative if not results with chain of command
  - 3. Report hazard or accident to MSHA if no miner representative is present
- C. Miner Rights Concerning Federal Laws
  - 1. The right to accompany inspectors at a mine
  - 2. The right to immediate inspection if a hazard or violation exists
  - 3. The right to compensation if a mine is ordered closed for health and safety reasons
  - 4. The right to receive copies of orders, notices, and citations on health and safety matters and have them posted
  - 5. All miners must receive health and safety training
    - a. Compensation for training time
    - b. Yearly refresher training and training certificates
  - 6. Medical rights
    - a. Examination for exposure to toxic materials
    - b. Audiograms for hearing loss
    - c. Black lung examinations and benefits
  - 7. Working conditions and equipment
    - a. Withdrawal if a danger exists
    - b. Right to examine roof control plan, examination of working places before shift and the right not to enter an unexamined area
    - c. Withdrawal due to improper ventilation, methane concentration, or insufficient oxygen
    - d. Right to inspect mine maps, have clean change rooms, a cap lamp, self rescuer, and clean drinking water
    - e. Exercising your right
      - 1. Firing, discrimination, and interference with your rights cannot be done because you filed a complaint or reported a violation
      - 2. Procedures for filing a complaint with the Secretary of Labor

D. Miners Rights and Obligations Concerning Kentucky Mining Laws
   1. Chapter 151
      a. 351.030
      b. 351.040
      c. 351.102 - 351.109
      d. 351.120
      e. 351.125
      f. 351.100
   2. Chapter 152
      a. 352.130
      b. 352.150
      c. 352.170
      d. 352.210
      e. 352.440
      f. 352.480
      g. 352.40
      h. 352.520
      i. 352.530
      j. 352.540

E. Women in the Coal Mines
   1. Rights
   2. Opportunities
   3. Relationship with fellow workers
   4. History of women in the mines

LABOR RELATIONS

The Role of the Union

OBJECTIVES:

1. The student will name two unions that are in Harlan County.
2. The student will state two services that a union performs in the coal industry.
3. The student will state four things that a union normally bargains for when negotiating a contract with a coal company.
4. The student will briefly state the role that the unions have played in the coal industry.

RESOURCES:

1. A representative of the U.M.W.A.
2. A representative of the Southern Labor Union.

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Class discussion.
3. Listening to speakers.

LABOR RELATIONS

The Role of the Federal Government and the Company

OBJECTIVES:

1. The student will explain the purpose of the Federal Mine Safety and Health Act of 1977, the purpose of Title 30 CFR, and the differences between the act and the regulations.
2. List in order the positions in the chain of command and the general responsibilities, functions, and rights of each position of a mining company.
3. Explain the company health and safety rules for an average mines.

RESOURCES:

1. MSHA Circular "Statutory Rights of Miners and Their Representatives Under the Act; Authority and Responsibility of Supervisors" - Pages 4-7.
2. Representatives from MSHA and the different chains of chain within the coal industry.

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Discussion of laws and responsibilities.
3. Assigned readings.
4. Listening to speakers.

LABOR RELATIONS

The Role of the Individual

OBJECTIVES:

1. The student will state and explain five responsibilities that he or she has concerning company regulations.
2. The student will list the procedures for miners in reporting hazards, accidents, and injuries.
3. The student will be able to identify certain rights including, but not limited to, the following: inspector accompaniment (section 103(f)), request for inspection (section 103(g)), and compensation for orders issued (section 111). These rights involve federal law.
4. The student will be able to identify certain rights including Kentucky Coal Mining Laws including, but not limited to, the following requirements for certification as section foreman, superintendent, shot firer, and electrical worker.
5. The student will list three problems that may arise and give solutions to each concerning women in the coal mines in relationship to fellow workers.

RESOURCES:

1. MSHA Circular - "Statutory Rights of Miners and Their Representatives Under the Act, Authority and Responsibility of Supervisors" - Pages 8-15.
2. Two women who are working in the coal mines.
3. A general mine foreman and section foreman of a mining company.
4. A federal and Kentucky state mine inspector.
5. "Laws Governing the Mining of Coal and Clay" Kentucky Revised Statues, chapters 351-352, amended 1976.

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Listen to speakers.
3. Assigned readings.
4. Class discussion.

GLOSSARY OF TERMS (Labor Relations)

Allegation. To accuse someone of having done something without positive proof that he did.

Audiogram. A hearing test.

Benefits. Payments made by the government to assist miners who have suffered an injury or illness on the job and cannot work. For example, a miner disabled by black lung disease can receive black lung benefits--payments to take the place of the salary he does not receive because he cannot work.

Black lung. Pnemoconiosis (black lung). Means a chronic dust disease of the lung arising out of employment in a coal mine.

Citation. (Summons or order). Shall be in writing and shall describe with particularity the nature of the violation, including a reference to the provision of the Act, standard, rule, regulation, or order alleged to have been violated.

Collective bargaining. Negotiating between organized workers and their employer for reaching an agreement on wages, hours, and working conditions.

Compensation. Pay received by a miner who, although able to work, was prevented from working for reasons he could not control (such as the mine being closed, or because he was in a training class).

Miner representative. Any person or organization which represents two or more miners at a coal mine for purpose of the Act.

Mine Safety and Health Administration (MSHA). Established in Department of Labor organization that sees that mine operators promote safe and healthful working conditions and abide by mine safety and health regulations.

Notice. Written document that a pattern of violations or mandatory health and safety standards exists in the coal or other mine which are of such nature as could have significantly and substantially contributed to the cause and effect of coal or other mine health or safety standards.

Order. Direction or command requiring the operator to cause all persons in the area affected by such violation, except those persons referred to in section 104 c of the Act to be withdrawn from, and to be prohibited from entering, such area until an authorized representative of the Secretary determines that such violation has been abated.

Section of a mine. Portion of the working area of mine.

Toxic material. Any material, such as a gas or chemical, that is harmful or poisonous to people and can cause illness, injury, or death.

Training plan. A system set up by a mine operator and approved by MSHA to train miners to work underground. The training plan must meet standards set up by government and have training in health and safety procedures and practices.

OCCUPATIONAL OPPORTUNITIES

OCCUPATIONAL OPPORTUNITIES

I. INTRODUCTION

A. Demand for Coal
1. Different industries and markets opening up

B. Factors that a Person Needs to Consider for a Rewarding Career in the Coal Industry
1. Education
a. Self-analysis
2. Training
3. Experience
a. Williness to learn
b. Advancement

C. Knowledge About the Coal Industry and a Certain Company
1. Coal industry
a. General structure of the industry
2. A certain company
a. Company's soundness
b. Its organization
c. Caliber of people
d. Coal reserves and market
e. Kinds of mining conditions
f. Moderization of equipment

II. COAL MINING AS A CAREER

Throughout the year the student has been exposed to areas of the coal mining industry and many of the jobs that are a part of these areas. They have interviewed the personnel of many of the jobs in the industry; have had class discussion concerning the different areas and jobs of the industry; and have seen many of the jobs being performed.
With this in mind, the student will choose one of the jobs in an area that is listed and write a paper concerning the qualifications, educations, advancement, salary, and advantages and disadvantages of the one he would like to have in the coal mining industry.

1. Underground Coal Mining
a. Continuous miner operator
b. Loading machine helper
c. Loading machine operator
d. Cutting machine helper
e. Roof bolter helper
f. Roof bolter operator
g. Continuous miner helper
h. Utility man
i. Cutting machine operator
j. Shot firer
k. Timberman
l. Shuttle car operator
m. Coal drill operator
n. Section foreman
o. Laborer
p. Rock duster

    q. Bratticeman
    r. Conveyor operator, beltman
    s. Mechanic
    t. Ventilation man
    u. Motorman
    v. Supplyman

2. Surface Mining
    a. Bulldozer operator
    b. Laborer
    c. Auger machine operator
    d. Electrician and mechanic
    e. Loader operator
    f. Shot firer
    g. Truck driver
    h. Other heavy machine operator
3. Construction: Jobs in Design and Erection of Plant and Underground Structures
4. Production: Jobs in Mine Management, Utilization of Production Equipment, and Labor Management
5. Maintenance: Jobs in Design and Operation of Processing Plant, Quality Control, and Product Inspection
6. Electrical: Jobs in Design and Installation of Electric Power Systems on Surface and Underground
7. Mechanical: Jobs in Equipment Design Modification and Layout, Water and Compressed Air Systems for Both Surface and Underground
8. Safety: Jobs in Inspection of Mine and Surface Plants for Hazards, Conformity With Laws Associated With a Mining Company and State and Federal Agencies
9. Industrial: Jobs in Time and Motion Studies, Labor Relations for Company or Union, and Insurance
10. Reclamation: Jobs in Rehabilitation of Mined Land, Forest, and Agriculture Management, Recreational Planning, and Development
11. Exploration: Jobs in a Coal Land Procurement, Planning for the Future Including Geological Survey and Core Drill Testing
12. Engineering: Jobs in Surveying, Mapping, and Long Range Planning
13. Marketing
14. Purchasing of Supplies and Services
15. Coal Transport to Market
16. Accounting and Finance
17. Public Relations

OCCUPATIONAL OPPORTUNITIES

OBJECTIVES:

1. The student will be able to relate the demand for coal as seen by increasing markets to the increasing number of jobs that will become available.

2. The student will be able to describe factors that need to be considered for a career in the mining industry.

RESOURCES:

1. Text - Elements of Practical Coal Mining - Pages 568-572.

PRESENTATION AND ACTIVITIES:

1. The student will select a mining company, and study its structure, type of mining, equipment and personnel employed.

2. The student will choose a particular occupation within the mining industry that he/she is particularly interested in, and research that occupation fully by writing a paper including the following information:
    a. Educational qualifications
    b. Age requirements
    c. Advancement possibilities
    d. Salary
    e. Fringe benefits
    f. Responsibilities-duties
    g. In-door out-door
    h. Certification
    i. Alone - with a partner
    j. Equipment used
    k. Mechanical skills
    l. Work day-shift
    m. Personal safety equipment
    n. Union or non-union
    o. Underground - surface

48-HOUR PRE-EMPLOYMENT REVIEW

I. SELF-RESCUER
  A. MSA W-65
  B. Drager 810

II. CHAIN OF COMMAND

III. ENTERING AND LEAVING MINES
  A. Mine Emergency Plan, Check-in, Check-out, Mantrip and Tran
    1. Mine Emergency plan
    2. Check-in procedure
    3. Check-out procedure
    4. Mantrip
    5. Tram
    6. Danger board
  B. Riding and Crossing Conveyor Belts
    1. Riding conveyor belts
    2. Conveyor belts - Be Careful
  C. Effective Communications
  D. Cap Light Communication Signals
  E. Two-Way Communication Systems

IV. ESCAPEWAYS
  A. Blocked Escapeway Procedures
  B. Mine Emergency Escape
  C. Barricading

V. ROOF AND RIB CONTROL
  A. Roof Supports
  B. Proper Installation of Supports
  C. Roof Bolting in Coal Mines
  D. Recognition of Hazardous Roof and Rib Conditions
  E. Sounding Roof and Ribs
  F. Sound and Vibration Method of Testing Roof and Ribs
  G. Using a Slate Bar
  H. When to Inspect Roof and Ribs
  I. Guidelines to Prevent Falls of Roof and Ribs
  J. Make the Roof Safe

VI. COAL MINE VENTILATION
  A. How Coal Mines are Ventilated
  B. Control of Ventilating Air
  C. Ventilation at the Working Face
  D. Check Curtain Construction and Safety
  E. Ventilation in Other Portions of the Mine
  F. Mine Maps and Legends

VII. ROCKDUSTING AND FIRE PROTECTION

VIII. FIRST AID
  A. Sequence of Action
  B. Respiration
  C. Back Pressure Methods of Artifical Respiration
  D Control of Bleeding

    E. Pressure Points
    F. Tourniquets
    G. Constricting Bandages
    H. Shock and the Treatment of Shock
    I. Fainting
    J. Open Wounds
    K. Dressing Wounds
    L. Closed Wounds
    M. Treatment of Closed Wounds
    N. Treatment of a Sprained Ankle or a Hernia
    O. Foreign Objects
    P. Burns
    Q. Fractures and Dislocations
    R. Treatment for Fractures and Dislocations
    S. Transporting the Injured
    T. Location of First Aid Equipment

IX. ELECTRICAL HAZARDS
    A. Basic Concepts of Electricity
    B. Coal Mine Electrical Systems
    C. Conductors and Insulators in the Mine
    D. Safety Around Trolley Wires
    E. Safety Around Power Centers
    F. Electrical Cable Safety
    G. Removing a Person From Electrical Contact
    H. Electrical Hazards in Underground Coal Mining

X. ACCIDENT PREVENTION
    A. Accident Causes and Prevention
    B. Lifting Procedures in High Coal
    C. Lifting Procedures in Low Coal
    D. Correct Ways of Carrying Hand Tools
    E. Proper Handling of Supplies and Materials

XI. EXPLOSIVES

XII. HEALTH AND SAFETY PROCEDURES
    A. Definitions of Health Terms
    B. Causes of Detection of Black Lung
    C. Use of a Respirator
    D. Effect of Noise on Hearing
    E. Dust Control Devices
    F. Sanitation Laws

XIII. GASES
    A. Methane
    B. Common Mine Gases and "Damps"
    C. Flame Safety Lamp
    D. Methane Testing Responsibilities

XIV. RIGHTS AND OBLIGATIONS
    A. State Laws
    B. Federal Regulations
    C. Company Rules

48-HOUR PRE-EMPLOYMENT REVIEW

OBJECTIVES:

1. Objectives are stated in the lesson plans of each unit covered during this course.

RESOURCES.

1. Text - Elements of Practical Coal Mining - Pages 1-572.
2. All of the MSHA Modules for the 48-Hour Pre-Employment Course.
3. Coal Mining Reference Book; 1973 Edition.
4. "Laws Governing the Mining of Coal and Clay" - Kentucky Revised Statues - Chapters 351-352, Amended 1976.
5. "Kentucky Mine Safety Training Program".
6. "Code of Federal Regulations", Revised July 1, 1978.
7. All revelant material and teaching aids used throughout the course.

PRESENTATION AND ACTIVITIES:

1. Lecture.
2. Class discussion.
3. Review class notebook.
4. Review of tests.

FIELD TRIPS
GUIDELINES FOR A FIELD TRIP
SAMPLE INTERVIEWING QUESTIONS

FIELD TRIPS

These field trips will provide first hand experience with the technical elements, careers, and saftey of coal mining. They will also make the material more relevant and provide a better understanding and reinforcement of the material that has and will be covered before and after each field trip.

1.) Field trip one will follow unit five, "A Basic Introduction to Underground Coal Mining". It will cover the first five units and provide a motivational experience in underground coal mining. The students will visit an idle continuous mining section.

2.) Field trip two will follow unit seven, "Ventilation and Dust Control".

3.) Field trip three will follow - "Fires and Explosions". They will go to a mine-rescue contest.

4.) Field trip four will follow unit thirteen, "Modern Mining Methods - Underground". The students will visit a mine that has a low coal section.

5.) Field trip five will follow unit fifteen and will cover all preceding units. The students will visit the Jenny Mine near Prestonsburg, Kentucky. It is a proving ground for new machines, both conventional and continuous.

6.) Field trip six will follow unit sixteen, "Modern Mining Methods - Surface". The students will visit a surface mining site.

7.) Field trip seven will follow unit seventeen, "Preparation, Sampling, and Analysis of Coal". The students will visit a preparation plant and a sampling and analysis lab.

8.) Field trip eight will follow unit nineteen, "Surveying and Mapping". Students will visit an engineering department of a coal mine.

There will be a discussion before and after each field trip concerning the content and purpose of the field trip. The students will also write a paper describing the trip.

GUIDELINES FOR A FIELD TRIP

1. What are some reasons for taking field trips?
    a. They help to bridge the gap between the school and the community.
    b. They provide students an opportunity to see "real" people.

2. What preparation should be made for the trip?
    a. Prepare the youngsters.
        1. Have them make questions and practice interviewing skills to use with workers.
            a. What kind of training is required?
            b. What tools or materials are used on the job?
            c. What are the duties of the job?
            d. Where does the person work?
            e. Does this person like his/her job?
            f. Does this person work with other people?
            g. How did the person get interested in this job?
            h. What did the person like to do as a child?
            i. Is there any danger on a job?
            j. What doesn't the person like about the job?
            k. Does the job interfere with the person's private life or time with family?

    b. Prepare the site for the visit.
        1. Indicate time of trip and number of students in group.
        2. Make sure that the site knows what to expect from the students.
        3. Arrange transportation and handle mechanics of obtaining permission from parents and principals.

3. Follow up trip with planned activities.
    a. Have debriefing session.
        1. Discuss characteristics of jobs.
        2. Talk about tools of the trade.
        3. Discuss educational and training needs.
        4. Identify applications of subject matter heavily used.

    b. Write letters to site.

    c. Have further follow up activities.

SAMPLE OF INTERVIEWING QUESTIONS

Occupational Opportunity Outlook

1. Name of occupation?
2. What type of work is done on this job?
3. What type of education and/or training is necessary for this kind of work?
    - Apprenticeship
    - Vocational School
    - College
    - Advanced Degree
4. What is the estimated cost of this education/training?
5. What courses in junior high or high school would you recommend for persons entering your field?
6. Are there any personal qualities for this job that are more important than diploma?
7. What provisions are made for updating your training?
8. Who bears the cost of your education and/or training?
9. Is it necessary for you to belong to a union or other professional organization?
10. Is there a uniform system of licensing at the local, state, or national level in your occupation?
11. Is there a special vocabulary used in your work?
12. What tools do you use in your work?
13. Are you required to purchase these tools?
14. What type of clothing do you use on your job?
15. What is the estimated cost per year for clothing and care of clothing?
16. Who pays for this clothing and its care?
17. Are there any limitations in your job? i.e., age, sex, race, height and weight, marital
18. What experiences and training on this job might prepare you for some other kinds of jobs if you ever want to change?
19. What caused you to enter this field?

20. What steps did you take to get this job?

21. Is anyone else in your family employed in this area?

22. Is this your first job?

23. What other jobs have you held prior to this one?

24. When did you first decide you wanted this type of job?

25. What part of your job do you like best?

26. What part of your work do you wish you did not have to do?

27. What do you consider the greatest advantages in your work?

28. What do you consider the greatest disadvantage in your work?

29. Are there any hazards in your work?

30. Are you expected to work overtime?

31. Are you paid for this?

32. What extra activities are you expected to participate in that are not specifically a part of your job?

33. What hours do you work?

34. Do you have to work nights? Holidays?

35. How does your job affect your personal life?

36. When does your boss compliment you?

37. When are people fired?

38. How much money can a person earn in this kind of work?

39. What is the beginning wage?

40. Do you get a bonus?

41. What kind of fringe benefits do you have in your work?

42. Who depends on your work?

43. Upon whom do you depend for your work?

44. Is noise a factor in your work?

45. Does your job require that you be nice to people all day-even people who are crabby and ill-tempered?

46. Is capital necessary to begin in your work? How much?

47. What changes have taken place in your job recently?

LIST OF RESOURCES

Books:

1. American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., Elements of Practical Coal Mining, Port City Press, Inc., Baltimore, Maryland, 1973.
2. Committee on Allied Health, American Academy of Orthopedic Surgeons, Emergency Care and Transportation of the Sick and Injured, George Banta Co., Inc., Menasha, Wisconsin, 1977.
3. Forbes, J. J. and Grove, G. W., Mine Gases and Methods For Detecting Them, United States Government Printing Office, Washington, D.C., 1954.
4. Leonard, Joseph W. and Mitchell, David R., Coal Preparation, The American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., New York, 1968.
5. Kentucky Revised Statutes - Laws Governing the Mining and Clay, Chapters 351-352, Department of Mines and Minerals, 1976.
6. Kentucky Mining Institute, Coal Mining Reference Book, 1973.
7. Title 30, Mineral Resources, Code of Federal Regulations, U.S. Printing Office, Washington, D.C., 1978.

Equipment:

1. Miners First Aid Station
2. Slide Trays
3. Recording Resusci-Anne
4. Digital Methanometer w/charger
5. Filmstrip Projector
6. Movie Projector
7. Screen
8. Slide Projector
9. Cassette Recorder
10. Boots
11. Oxygen Indicator
12. Flame Safety Lamp

13. Birams Anometer w/carrying case
14. Birams Anometer less carrying case
15. Leather Carrying Case for Davis Anometer
16. Respirator
17. Methanometer Tester
18. Draeger Training Self-Rescuer
19. Repair Kit for Koehler Model Flame Safety Lamp
20. Repair Kit for Wheat Mark V Cap Lamp
21. Battery Filler for Wheat Mark V Cap Lamp
22. Wheat Nat'l Mark V Camp Lamp
23. Automatic Charger for Mark V Camp Lamp
24. Miners Belts
25. Methanometer w/Probe Fitting
26. Carrying Case for Methanometer
27. Telescopic Brass Sampling Probe
28. Single Unit Charger for G7011 Methanometer
29. Safety Glasses
30. Knee Pads
31. Leg Pads
32. Hearing Protectors for Hard Cap
33. Cylinders
34. First Aid Station

Films:

1. Rock Bolting Safety
2. The Care & Use of A Permissible Flame Safety Lamp
3. Mine Rescue Contest Training
4. Rubber Tired Haulage
5. Mine Emergency Operation

6. Safety in Longwall Mining
7. Face Ventilation in Underground Coal Mines
8. Twenty-five Feet from the Face
9. Make the Roof Safe
10. Fighting Coal-Mine Fires
11. Plan for Survival
12. Oh! My Aching Back
13. Orientation & Indoctrination of Safe Workmen
14. Coal Miner--Today
15. First Things First
16. Conveyor Belts - Be Careful
17. Mining Noise Hazards
18. Artificial Respiration
19. Control of Bleeding
20. Physical Shock
21. Open & Closed Wounds
22. Burns & Scalds
23. Fractures & Dislocations
24. Transportation
25. Cardiopulmonary Resuscitation
26. Underground Coal-Mine Blasting
27. Electrical Lock-out Procedures

MSHA Modules (Circulars):

1. Clean-up and Rock Dusting
2. Drager 810 Self-Rescuer

3. Electrical Hazards
4. Ground Control - Surface
5. Hazard Recognition and Avoidance - Surface
6. Hazard Recognition and Avoidance - Underground
7. Health - Surface
8. Health - Underground
9. Health and Safety Aspects of Assigned Tasks - Surface
10. Health and Safety Aspects of Assigned Tasks - Underground
11. Introduction to the Work Environment
12. Mine Gases
13. Mine Map, Escapeways, Emergency Evacuation, and Barricading
14. M.S.A.W-65 Self-rescuer
15. Respiratory Devices
16. Roof and Rib Control
17. Statutory Rights of Miners and Their Representatives Under the Act; Authority and Responsibilities of Supervisors - Surface
18. Statutory Rights of Miners and Their Representatives Under the Act; Authority and Responsibilities of Supervisors - Underground
19. Transportation and Communication
20. Ventilation

Slides:

1. Job Safety Guide - Continuous Miner Operation
2. Job Safety Guide - Roof Bolting Operation
3. Job Safety Guide - Shuttle Car Operation
4. M.S.A. Carbon Monoxide
5. Rubber-Tired Front-End Loader and Fork Lift

Slides - Cassettes:

1. Kentucky Mine Safety Training Program, Bureau of Vocational Education

Transparencies:

1. Koehler and Wolf Permissible Flame Safety Lamp
2. Permissible Methanometer
3. Principles of Mine Rescue